LABS ACCOMPLISHMENTS

Exceptional service in the national interest

Sandia National Laboratories

Sandia LabNews

March 2014

To all Sandians:

Welcome to the 2014 edition of the Labs Accomplishments. In it, you'll find brief descriptions of some of the very best work performed at Sandia during FY13. These accomplishments are a window into the Labs. They clearly demonstrate why DOE-NNSA rated our mission work as "excellent" in our FY13 Performance Evaluation Report and why it found much to praise in the strides we are making as a model 21st century government-owned contractor-operated laboratory.

PAUL HOMMERT

Let me first say that these accomplishments reflect the success of our work guided by the five objectives for securing the future of the Laboratories as described in our strategic plan. In particular, they vividly demonstrate how our capabilities and resources developed over the past 60 years to execute our core nuclear weapons mission are being applied to broader national security challenges in the areas of nonproliferation, counterterrorism, cyber security, energy security, defense, and homeland security.

In the past two years, our leadership team has spent considerable effort on finding ways to amplify Sandia's national security impact, one of our strategic objectives. In doing so, the team has raised the bar for strategic management of our mission and capability space. A new framework for describing the Labs' mission and capability space has been outlined in the recently published FY14–FY18 Strategic Plan. We identified seven integrated mission areas in addition to our nuclear weapons mission area; they are described in detail on the next page.

Sandia's eight mission areas — underpinned by a robust foundation of capabilities and rich resources in people, research, facilities and tools — define us as a 21st century national security laboratory. The new framework enables us to continue to solve the toughest problems with which the nation entrusts us day after day.

The 2014 *Labs Accomplishments*, taken collectively, are an eloquent statement that we are doing just that and living up to our core purpose, first articulated in 1949, to render "exceptional service in the national interest."

Paul Hommert
Sandia President and Laboratories Director

Sandia's Strategic Objectives

- Deliver with excellence on our commitments to the unique nuclear weapons mission
- Amplify our national security impact
- Lead the Complex as a model 21st century government- owned contractor-operated national laboratory
- Excel in the practice of engineering
- Commit to a learning, inclusive, and engaging environment for our people

Our values

Sandia has five core values, which are used to inform our daily decisions, shape our performance, and enable us to achieve success as one lab with one national security mission.

We serve the nation by responding to the requests of our customers and by anticipating our country's future needs. We complete our mission even in the face of challenges and ambiguity, and seize every opportunity to "render exceptional service in the national interest."

We deliver with excellence by meeting our commitments, hiring the best, working collaboratively, and committing ourselves to continuous improvement to advance the frontiers of science, engineering, and technology.

We respect each other by cherishing the intellect, skills, diversity, flexibility, and passion of our coworkers. We cultivate the development of all members of our workforce and commend their world-class accomplishments, which enable Sandia's mission.

We act with integrity by living consistently within our principles, by telling the truth, and complying with the law.

We team for great results by sharing a common vision and by fostering an attitude of mutual respect with all our partners. We combine our talents to benefit each other and our customers, working to ensure that everyone gains from our collective achievements.

ALL HANDS — Energy Secretary Ernest Moniz, at podium, addresses an all-hands meeting at Sandia, telling a full house at the Steve Schiff Auditorium that "We have work to do . . . and it's quite broad in its reach." Joining Moniz on the stage are, from left, Albuquerque Mayor Richard Berry, US Rep. Ben Ray Lujan, NNSA Sandia Field Office Manager Geoff Beausoleil, NNSA's then-acting Administrator Bruce Held, and Sandia President and Labs Director Paul Hommert. (Photo by Randy Montoya)

Mission areas

Sandia's eight mission areas bring new focus to the work in the broader national security mission space that is required to effectively execute the nuclear weapons mission. Four of these mission areas — reducing global nuclear dangers, providing nuclear assessments and warning, defending and dominating in cyberspace, and maintaining US defense technological superiority through synergistic products — are strongly interdependent with, and essential to, sustaining Sandia's ability to fulfill its nuclear weapons mission. In turn, the core nuclear weapons mission enables these broader national security missions, allowing Sandia to leverage the broad scope of the work and thus provide a unique value to the nation. The four mission areas, when combined with the nuclear weapons mission area, effectively define a new core for Sandia.

Three additional mission areas — maintaining US defense technological superiority through leveraged innovations, reducing global chemical and biological dangers, and ensuring a secure and sustainable energy future — are critical to our national security and enhance our capabilities.

Sandia provides vital expertise, technologies, and facilities to address these three mission areas, which are distinguished from the four discussed above in that their synergy with the nuclear weapons mission area is more effectively managed by connectivity in capabilities rather than direct products. However, they do have direct product connectivity to the broader core defined above. By working in these mission areas, Sandia ensures the maximum leverage of our core capabilities to the benefit of solving national security challenges. (See more on Sandia's mission areas on the next page.)

Inside

Ron Maes, in foreground, and Jeff Meador (both 2155) prepare a B61-12 test assembly that will used to study and understand the behavior and performance of weapon components and systems under a variety of conditions. The work is part of Sandia's B61 Life Extension Program.

Read more about Sandia's NW work beginning on page 4.

Cover photograph by Randy Montoya

This year's *Labs Accomplishments* publication recognizes some of Sandia's best work during 2013, as submitted by center offices and selected by division offices. Most citations are followed by the numbers of the centers that contributed most directly to the effort described.

The acronym after most of the accomplishments indicate which of Sandia's program management units (PMUs) the work most directly supported. The PMU acronyms are:

NW: Nuclear Weapons PMU
DSA: Defense Systems & Assessments PMU
IHNS: International, Homeland, & Nuclear Security PMU
EC: Energy & Climate PMU
IMS: Integrated Mission Support
WFO: Work for Others

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Sandia National Laboratories

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corp., for the US Department of Energy's National Nuclear Security Administration.

Amplifying our national security impact

Eight mission areas bring new focus to Sandia's key role in addressing national security challenges

Sandia's eight mission areas provide strategy for the Laboratories' program management units and foundation. The mission areas also communicate the priority ascribed to different national security challenges for which Sandia may contribute solutions by focusing its investments in capabilities, people, infrastructure, and tools. The mission areas allow us to bring new clarity to what we have long held to be essential, namely, that the long-term health of capabilities necessary to execute the nuclear weapons mission requires broader national security mission work.

Nuclear Weapons

In its role as the country's nuclear weapons systems engineering laboratory, Sandia weaponizes the nuclear explosives package to create a militarily effective and logistically sustainable US nuclear deterrent. Through its pulsed power and high energy density physics expertise, Sandia also plays a critical role in the fundamental science that underlies nuclear weapons and their vulnerability to radiation.

Sandia has full life-cycle responsibilities for all nuclear weapons in the US stockpile. These responsibilities range from early exploratory concepts through design, qualification, deployment, ongoing maintenance, and evaluation to, ultimately, dismantlement and disposition. This highly complex technical challenge requires an array of engineering and scientific disciplines underpinned by deep unique capabilities, including microsystems, major environmental tests, pulsed power, materials science, and advanced computing.

To meet these challenges, the nuclear weapons mission area (NWMA) develops forward thinking, paradigm-shifting strategies and associated strategic plans to provide guidance to the Nuclear Weapons Program Management Unit, as well as to the new core mission areas: Global Nuclear Dangers, Nuclear Assessments and Warning, Cyberspace, and Synergistic Defense Products. The NWMA works in partnership with these four mission areas to ensure the mutual understanding and support of each other's mission needs and capabilities. In developing these strategies and plans, the NWMA will balance the requirements of (1) stewarding the current nuclear stockpile, (2) modernizing the stockpile into the future through life extension programs and alterations, and (3) advancing the foundational aspects of our science and engineering capabilities, business and management tools, people, and facilities and infrastructure.

The NWMA will also lead the nuclear weapon enterprise in the development of revolutionary (rather than evolutionary) ways to execute our nuclear weapon mission, and in partnership with the Nuclear Weapons Program Management Unit, will engage with the NNSA, the NNSA laboratories and production agencies, the DoD and other leaders across the country's NW enterprise to ensure that the near-, mid-, and long-term challenges facing the national security enterprise are mutually understood.

Reduce Global Nuclear Dangers

Sandia's Reducing Global Nuclear Dangers mission area is directly connected to the nuclear weapons mission in two ways. First, it requires understanding of nuclear weapon incidents and of the design, production, transportation, and security of nuclear weapons. Second, it informs nuclear weapons planning through an understanding of arms control, treaty requirements, and the relationship between deterrence and nonproliferation.

Reducing Global Nuclear Dangers involves addressing risks and improving the situational awareness of emerging risks posed by (1) nuclear weapons — whether controlled by the US or another nuclear weapon state, or whether they are in the hands of rogue states and non-state actors and terrorists; (2) the misuse of nuclear and radiological materials, nuclear weapons knowledge, and/or nuclear weapons components; and (3) a large-scale radioactive release from a nuclear power plant.

Reducing Global Nuclear Dangers is a mission area with a broad scope, developing technologies and solutions for both domestic and international applications.

Provide Nuclear Assessments and Warning

In service to NNSA's nuclear nonproliferation mission, Sandia has long provided sensing systems and analysis to detect nuclear detonations and understand nuclear threats against the US and its allies. These threats involve extremely difficult technical challenges associated with denied access and active deception by non-cooperative nation-states, the emergence of non-state actors, the need to perceive threats early in their life-cycle and in their actual employment, and the subtle nature of threat signatures. The nation relies on Sandia not only to understand the threats, but also to counter the threats with analysis and technology. Three key elements of this mission area are (1) developing technologies and systems to detect, evaluate, and disseminate information on nuclear detonations to decision makers in a timely manner; (2) providing analyses and assessments to help the US counter existential threats and avoid strategic technology surprise; and (3) developing pathfinding technologies and systems to track items, events, people, communications, and transactions across the full spectrum of human interactions.

Defend and Dominate in Cyberspace

Computers and networks, both wired and wireless, have become an essential technology for economic competitiveness and for the nation's critical infrastructure. Moreover, commercial networks form the backbone of much of the US military and intelligence networks. As information technology has become more vulnerable, the US cannot be confident that its critical IT systems will work under attack from a sophisticated and well-resourced opponent that uses cyber capabilities in combination with its entire military and intelligence capabilities. Sandia's key products in this area include (1) tools and techniques to improve cyber defense in depth, networks, surety of data and communication, and trust added to systems built from untrusted components; (2) technologies and techniques to determine vulnerabilities and associated defenses, detections, and remediations that keep pace with commercial advancements in communications, microelectronics, computational systems (static and mobile), and software; and (3) technologies and techniques for the US to assess situational awareness, assure resilient command and control of strategic and tactical systems, and support DoD in the evolution of networks becoming a warfare platform.

Maintain U.S. Defense Technological Superiority through Synergistic Defense Products

This mission area focuses on a set of national security products to provide technological superiority to critical national security needs. Highly synergistic with the products of Sandia's core NW mission, these defense products actively draw from and feed back into the NW program, and they support a variety of Defense, Intelligence, and Homeland Security missions. Among key products are radars, hypersonic strike systems, ballistic missile defense technologies; directed energy systems; explosives technologies; electronic subsystems; and tagging, tracking, and locating systems.

Reduce Global Chemical and Biological Dangers

Chemical and biological agents in the possession of hostile states and terrorists now represent a major security challenge facing the US. The biological threat includes naturally emerging, traditional, and engineered agents. The global stockpiling and use of toxic chemical agents present a similarly complex risk environment, ranging from traditional agents developed for chemical warfare to new classes of hazardous chemicals. Sandia is responding to the complex challenges of this threat environment by developing sophisticated prevention, preparation, and response strategies and technical solutions based in sound analysis, innovative solutions, and state-of-the art science and engineering. To that end, Sandia (1) works internationally to reduce the risk of biological or toxic chemical agents falling into the hands of our adversaries; (2) designs CB warning and response architectures for civilian protection and plays a central role in their deployment, operation, and response; (3) develops next-generation CB detection systems — including devices that can monitor a person's exposure to a toxin or pathogen; and (4) leads national efforts in CB event response and recovery by providing tools and expertise in event characterization, crisis management, decontamination, and restoration of capability and infrastructure.

Ensure a Secure and Sustainable Energy Future

Shifting geopolitical dynamics create a broad spectrum of challenges that could threaten the US energy future. Immediate and long-term threats affecting energy stability — such as the depletion of fossil fuels which is compounded by carbon emission concerns — add layers of complexity to ensuring a secure and sustainable energy future. Through a diverse, sustainable energy research, development, and demonstration portfolio, Sandia has built an expansive experience base and a suite of capabilities that address energy sustainability. Sponsored program-level efforts have resulted in significant progress in (1) renewable and fossil energy, including concentrating solar and photovoltaics, wind, hydrokinetics, geothermal, biomass, and natural gas drilling; (2) electric grid integration and resiliency and the integration of stored renewable energy; (3) safety and security of nuclear power systems and nuclear waste management; (4) cleaner and more efficient vehicle technologies; and (5) energy efficiency in solid-state lighting and innovative semiconductors.

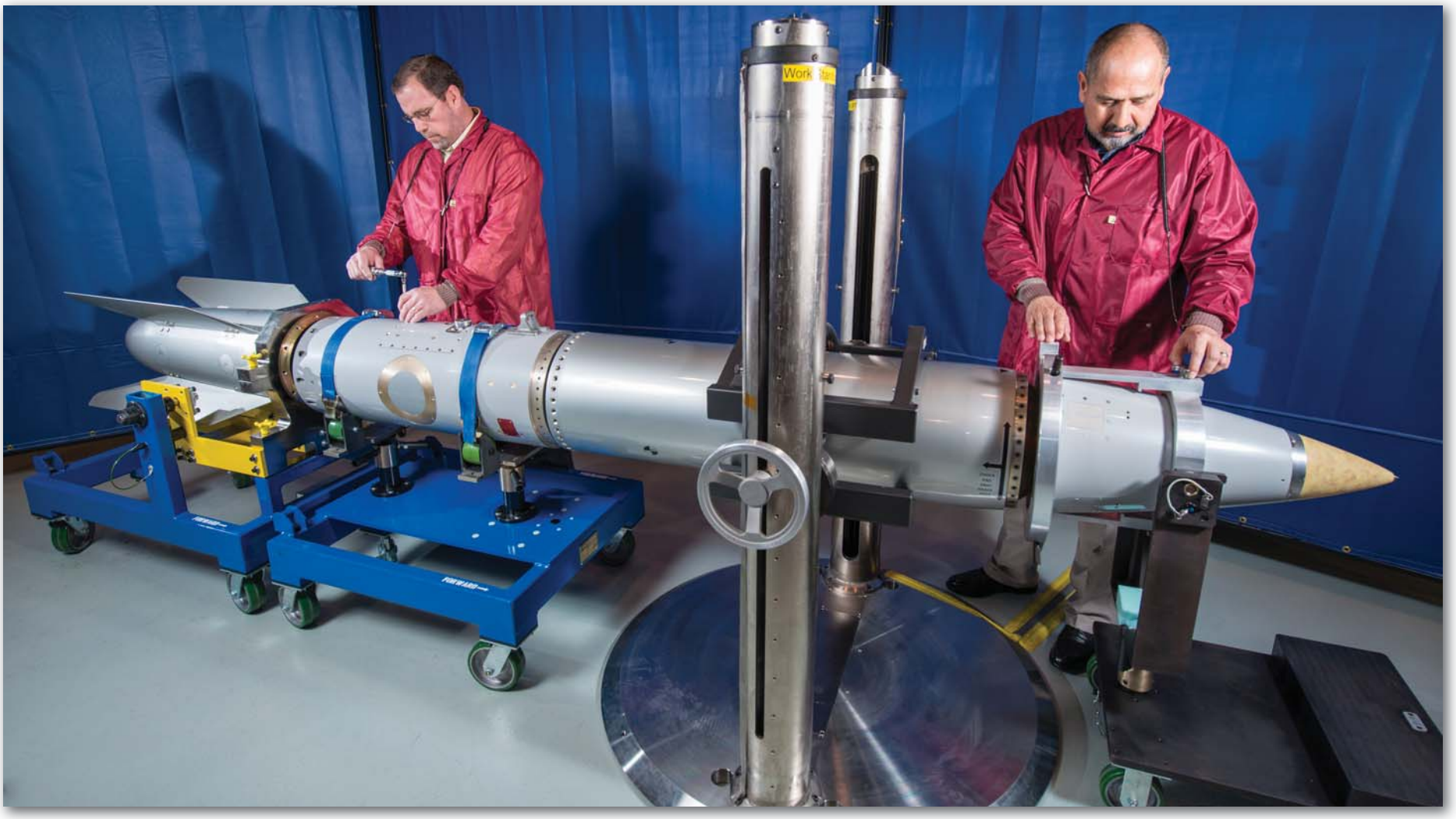
Maintain U.S. Defense Technological Superiority through Leveraged Defense Innovations

This mission area focuses on a set of national security products that provide technological superiority to critical national security needs. These products derive from capabilities necessary to perform Sandia's core NW mission. In aggregate, they support a broad set of Defense, Intelligence, and Homeland Security missions such as (1) high-performance nonnuclear sensing, (2) anticipating and countering novel asymmetric threats, (3) providing sensor access to difficult areas, (4) key enabling technologies for warfare dominance and response, and (5) applied data intelligence and decision support systems. Rocket-based launch systems are one example of key leveraged products. Another example is satellite system development, including satellite precision mechanisms and stronglinks, digital and analog electronics, environmental modeling/simulation/testing, navigation and control, and systems engineering. Other key products in this area include (1) ballistic missile defense systems and technologies, (2) sensors, (3) launchers, (4) physical security systems, (5) small satellite pathfinders, (6) hard target defeat systems, (7) systems for space situational awareness, and (8) systems analytics and technical assessments.

Labs foundation underpins mission areas

The Laboratories' foundation — the very base that gives our institution its energy, meaning, and uniqueness — is composed of our people, research, facilities and tools, and capabilities. In keeping with our vision to be the nation's premier science and engineering laboratory for national security and technology innovation, we recruit the best and the brightest, equip them with world-class facilities and tools, and build upon long-standing research by advancing the frontiers of science and engineering, giving rise to unique capabilities that differentiate Sandia's ability to deliver its mission.

Nuclear weapons engineering



TEST PREP — Ron Maes, at right, and Jeff Meador (both 2155) prepare a B61-12 test assembly that will used to study and understand the behavior and performance of weapon components and systems under a variety of conditions. The work is part of Sandia's B61 Life Extension Program. (Photo by Randy Montoya)

The US Air Force is developing Long Range Standoff (LRSO) platform to replace the presently deployed Air Launched Cruise Missile. NNSA commissioned Sandia, in collaboration with Los Alamos and Lawrence Livermore national laboratories, to complete a sequence of warhead system integration studies based on three parent designs: the legacy W80 and W84 cruise missile warheads and the B61-12 gravity bomb presently in development. Study outcomes were captured in extensive reports delivered to NNSA, accompanied by rapid prototype models of several key concepts. A preliminary draft of a missile-to-warhead interface control document was supplied to the Air Force. NW (8200, 2100, 8100, 240)

The DOE and DoD Joint Integrated Lifecycle Surety (JILS) project is a multi-agency surety risk analysis effort informing critical decisions for the nuclear weapons complex. This year, the core team led by Sandia, with US Air Force, US Navy, Los Alamos and Lawrence Livermore national laboratories, and NNSA participants, fulfilled the "Defense Programs Getting the Job Done in FY2013" goal for JILS. The team evaluated more than 4,000 baseline scenarios and potential surety upgrades. The core team involves experts in venue security, asset security, intelligence, systems analysis, and risk analysis. NW (8200, 8100, 6600, 6500, 400)

Sandia successfully completed qualification of the joint US/UK Autonomous Reentry Body Environmental Data Logger (ARBEDL) and delivered the first UK mission unit. The first US mission unit was assembled and will be delivered to the Navy in December. The UK Mission Final Readiness Review was completed in October. ARBEDL II employs a data-logger and multiple environmental sensors, designed to operate autonomously at low power for long durations to gather shipboard environmental data, which may be used to supplement or update the Stockpile to Target Sequence. NW (2600, 5400, 2500, 2900, 8200, 1500)

LRSO TEAM — Lee Druxman, Bryn Miyahara, and Andrew Van Blarigan (all 8248) assemble a 3-D model used to illustrate high-level Long Range Standoff concepts. (Photo by Dino Vournas)

NICK DEREU

Sandia and B&W Pantex team to perform the complex work required to ensure that key deliverables for the nation's nuclear weapon stockpile are safe, secure, reliable, and on schedule. **Nick DeReu** (2132) is the Pantex program manager and the main Sandia liaison to Pantex. This year he led the significant accomplishments of updating Sandia's portion of the W76-1 LEP Weapon Response and Authorization Basis, resolving challenges with unique anomalous units, and planning long-term program activities. Nick has been the Sandia representative with NNSA, Pantex, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia executive management as well as with the Defense Nuclear Facilities Safety Board in this responsibility. Nick is the W76-1 LEP project manager and has provided the leadership that has kept deliveries of that system to DoD safe, secure, reliable, and on schedule. Nick's accomplishments and impacts are recognized and respected by NNSA and DoD executives.

Nuclear weapons engineering

North Atlantic Treaty Organization (NATO) delegates who toured Sandia in 2013 focused on programs supporting extended deterrence to US allies and broader national security programs ranging from homeland security to preventing the proliferation of weapons of mass destruction. The visit highlighted the Sandia science, technology, and engineering required to implement US policies supporting the alliance's essential purpose — to safeguard the freedom and security of its members through political and military means. More than 50 NATO representatives from 23 European countries participated, plus many other officials. NW (200)

MORE THAN 50 REPRESENTATIVES from 23 NATO countries toured Sandia during a May 2013 three-day visit, along with officials from DoD, NNSA, the US Department of State, and other federal agencies. (Photo by Randy Montoya)

The power-free gas sampler (PGS) is now in use at Pantex for surveillance of all active nuclear weapon systems following W87 and W80 qualification this year. This completes a five-year effort to replace AC-powered gas samplers. The PGS can be operated during lightning warnings, saving time, money, and schedule impact. Additional savings have resulted because required weekly PGS qualification activities could be moved from the weapon bay to the lab, freeing up several technicians and a weapon bay for up to four hours a week per program. NW (1800, 400, PX)

Laboratory Test Assembly Tracking (LTAT) End-to-End Demonstration Infrastructure/Operations/Capability. **An end-to-end demonstration of the entire LTAT process was successfully completed** and showed a new approach for sharing data cross-site as part of the PRIDE Enterprise Data Sharing Initiative. This project automated the sharing of manufacturing data between Pantex and Sandia and enables viewing of Record of Assembly information along with the associated surveillance test data, making data analysis to support the Annual Assessment Review process much more efficient. NW (2900, 9300, 9500)

A sophisticated special-purpose switch that serves as a permissive action link (PAL) has provided Use Control in the enduring stockpile for more than three decades. A comprehensive life assessment was performed to determine the remaining reliable service life for the switch as a result of radiation-induced degradation. Radiation testing/transport modeling, circuit simulation, and reliability analysis were conducted to identify and characterize failure mechanisms. The results of this work drove informed decisions for Sandia's nuclear weapons mission. NW (2100, 1300, 1700)

Independent Surety Assessment completed initial surety assessments on the B61-12 Life Extension and W88 Alt 370 system conceptual designs. The assessments addressed identification of risk and opportunities for improvement in nuclear safety, use control, reliability, surveillance, and engineering quality using the NWSMU Assert, Challenge, Conclude process. Results are reviewed with the Weapon Project Teams and Senior Nuclear Weapons management and documented in formal assessment reports. The project teams have provided initial response and are addressing the issues raised as appropriate. NW (400, 2100, 8200)

The B61-12 program completed all key program milestones in accordance with the schedule for full-scale engineering development. The team demonstrated systems engineering rigor through successful completion of multiple component-level conceptual design reviews involving numerous Sandia nuclear weapon design organizations. The team also successfully executed numerous development tests in support of establishing a robust technical basis, including system-level mechanical integration testing, two radar drop tests, and tests demonstrating communication between critical NNSA and DoD subassemblies. NW (2000, 1000, 5000, 6000, 8000, 10000, 200, 400, 500)

Test team members gather at Sandia's Tonopah Test Range for a B61-12 radar drop test.

A multidisciplinary team of code developers, analysts, and experimentalists successfully completed computational and experimental simulations to develop and validate electromechanical impact fuze models for the W88-0 and W88 Alt 370. High-performance computing models will be used to simulate reentry body response over a range of impact conditions and subsequent loads on the fuze to assess uncertainties. This work won an NNSA Defense Programs Award of Excellence. (1400, 1500, 1600, 2100, 2600, 2900) NW

W88 Hostile Environment Radiation Environment Surveillance: **Completed experiments to characterize and quantify aged performance of key W88 stockpile system components** in hostile environments, supporting the W88 stockpile system as well as potential reuse of components in the W88 ALT370. This is the first time hostile-environment experimental surveillance of aged components for the W88 has been performed. This effort re-establishes a quantitative performance baseline for selected components in conjunction with the original qualification basis. NW (200, 1300, 2100)

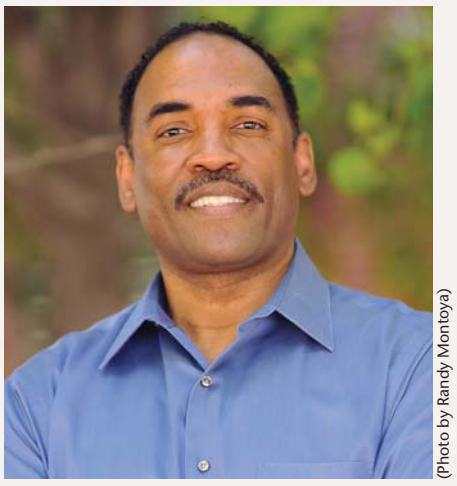
T**he B61-12 system-level Nuclear Safety Specification, released on Oct. 15, 2013, represents a milestone for the complex** as the first system-level specification jointly developed and released between Sandia and Los Alamos national laboratories. The specification derives and captures all necessary and sufficient nuclear safety design requirements and identifies the responsible Design Agency owner. It also captures the safety philosophy differences between the two laboratories and identifies how the two philosophies integrate to support a complete system-safety assessment of the B61-12. NW (400, 2100)

We demonstrated the first operational Path Length Module (PLM) assembly built with custom mixed-signal complementary metal oxide semiconductor application-specific integrated circuits and HBT-based small scale integrated circuits produced in Sandia's Microelectronics Development Lab and MicroFab, respectively. The PLM for the W88ALT370 and MK21 Arming and Fuzing Assembly programs replaces the legacy FBIA. The PLM combines new MESA ASIC and HBT technology with a legacy accelerometer, and meets aggressive performance requirements. NW (1700, 5300)

Weapon facilities and security

Departments 6234, 1532, 1534, and 1535 completed engineering tests for a large, radioactive material air transportation package, providing proof-of-concept of being able to meet very severe air transport requirements. This package uses a technology for which Sandia holds a patent and conveys program leadership in developing air transport packages. Substantial analytical and field testing expertise was conducted to achieve program success. EC (6200, 1500)

PACKAGE FULLY ENGULFED in a jet-fuel pool fire for one hour at the Lurance Canyon Burn Site following an impact test. (Photo by Randy Montoya)



(Photo by Randy Montoya)

RON MCINTOSH

Ron McIntosh provided significant contributions to Sandia and the DOE Classification and Weapons Community by instituting and maintaining classified subject-matter briefings to the Sandia community, developing and beta testing revolutionary three-dimensional classification guidance. In 2013, he submitted the B-61 Classification Guide for DOE approval. Ron co-chairs the Neutron Generator Evaluation Group with DOE HQ Office of Classification to evaluate neutron generator technology. Their recommendations, including five declassification proposals, gained the full approval of the Technical Evaluation Panel. He was the recipient of the 2013 DOE HQ Classification Award of Excellence.

The Sandia Silicon Fabrication Revitalization (SSiFR) effort is well underway in Microsystems & Engineering Sciences Applications (MESA). The SSiFR team accomplished a significant milestone in FY2013 by retiring the photolithography scanner system. A newer system was procured in FY2013 and installed last August. The system is now safely secured on a pedestal in the cleanroom. Work is ongoing in FY2014 to complete construction and qualify for NW production by the end of the fiscal year. NW (4800, 1700)

Triage is a dedicated group of expert analysts from Sandia, LANL, and LLNL who provide 24/7 analysis of suspicious alarms from radiation detectors across the world. The data provided varies from portal data to handheld detectors from local law enforcement. The analysts identify and quantify the radioisotope(s) using analysis tools developed at Sandia and LANL for rapid analysis of spectral data, threat assessment, and response recommendation. Triage is coordinated by NNSA and the Department of Homeland Security's Domestic Nuclear Detection Office. IHNS (6600, 8100)

A unique Sandia-designed sensor has been successfully installed and tested at a US Navy site. This design was required to complete a security perimeter through a marsh region at the site. Sandia developed a sensor configuration to meet federal wetlands regulations while restricting access under a bridge to meet DoD requirements. This is one section of an overall Sandia-designed Perimeter Intrusion Detection System scheduled for completion in 2015. IHNS (6500)

An upgraded security system was designed and installed by Sandia to provide additional levels of security for the storage complex at Kirtland Air Force Base. In early February 2013, the government successfully performed an acceptance test of the Topside Camera and Electronic Security System refresh for the Kirtland Underground Maintenance and Munitions Storage Complex. The system was designed and installed by personnel in Sandia's Dept. 6510. IHNS (6500)

Despite challenges involving scope, schedule, and budget, the Facilities Management and Operations Center (FMOC) worked with the DOE/NNSA Sandia Field Office to renovate 60,000-plus square feet of usable "shell space" in Bldg. 840. The former machine shop was repurposed in 2013 into a multifunction research/laboratory space, including upgrades, making the facility "complete and usable." In November, FMOC completed stand-up of 20,000-plus square feet of high-bay test lab and evaluation workspace that will support nuclear weapons-related activities. Work is in progress to complete additional space build-outs for other national security mission work. DSA, NW (4800, 10500, 10600

Product realization

INTRICATE DETAIL — Joseph Martinez (2993) examines a complex spherical shape rendered in Sandia's Fortus 3D printer made by Stratasys. The sphere, while not representing any particular component, demonstrates the capabilities of the machine. (Photo by Randy Montoya)

Center 2900 established a 3D printing center of excellence to satisfy increasing needs for high-quality, 3D printed parts and assemblies. 3D printing enables the creation of thermoplastic parts from computer-aided design models. The process is quick, inexpensive, and is ideal for the rapid turn-around conceptual design and development needs of weapon and non-weapon related programs. A full-scale model of a component of the Long Range Standoff Cruise Missile, built entirely of 3D printed parts, was delivered to NNSA to support a weapon modernization study. NW (2900) (Photo by Randy Montoya)

Tonopah Test Range completed two successful radar drop tests on Aug. 14-15, 2013. The flight tests validated radar fuze functionality in the B61-12 LEP configuration and is the first demonstration of performance for the redesigned radar in a representative gravity bomb configuration outside of the laboratory environment. The test asset originated in Center 2100 and personnel at TTR teamed with Dept. 2159 to design carriage, loading, and flight safety measures to execute these tests in less than 45 days. NW (2900, 2100, Remote Sensing Lab)

Through successful line implementation of corrective actions, the Sandia Production Program recovered product acceptance metrics in FY13. The program delivered production lots with a substantially lowered average defect rate, a 93 percent first-time acceptance rate, and 100 percent overall acceptance rate. The dual capacitor transitioned from a negative inventory position at Kansas City Plant (KCP) to an eight-plus month supply of capacitors; processing yield increased from 54 percent on Lot 7 to greater than 90 percent on lots 9-12. Additionally, a new custom explosive timer/detonator was delivered to the stockpile as part of the W87 Neutron Generator production deliverable. NW (1700, 2500, 400, 10600, 2900, 1800, 1500, 10200, 2700, 2800)

Based on the Sandia Key Data Processor architecture, Sandia has developed and fabricated the Common Authentication Module Application Specific Integrated Circuit (CAM ASIC), a secure processing platform meeting strict National Security Agency security requirements for Nuclear Command and Control and similar high-consequence applications. Built on Sandia's 350nm CMOS7 rad-hard Eiger platform, the CAM ASIC engineering development followed best practices including requirements traceability, formal verification, and Universal Verification Methodology (UVM) to deliver fully functional parts within 15 months of the design start. NW (2600, 2100, 1700, 5600)

The first Sandia-produced small ferroelectric neutron generator was formally accepted for war-reserve use for the W87. The successful qualification resolved a significant technical issue. The effort drew upon expertise across Sandia and peer review across the Nuclear Security Enterprise and beyond. The system-level limited-life component exchange qualification was completed at Pantex, followed by NNSA acceptance of the first W87 neutron generator exchange (first production unit). This significant milestone was achieved through teamwork and close coordination between Sandia and Pantex. NW (400, 1100, 1400, 1500, 1700, 1800, 2500, 2600, 2700, 5400, 8200)

The development, validation, and implementation of a Phase 1 battery model was accomplished in a collaborative effort between organizations 2540, 1510, and 1830. The model allows for model-based design of thermal batteries using first principle, science-based couple physics multi-scale (time and space) descriptions of fundamental processes occurring in an activated thermal battery. This new design approach has already eliminated one design-build-test cycle of product development and holds the promise to further decrease the development time and cost of new thermal battery designs. NW (2500, 1500, 1800)

Cody Love (2552) demonstrating laser welding explosive components to provide hermetically sealed devices.

The Rapid Prototype Facility (RPF) was constructed and staffed to enable concurrent design and prototyping of explosive detonators and igniters. This new capability reduces development cycles from months to days, evaluates manufacturability of the design in the early stages of development, and accelerates the transition of components from design to production. The flexibility and expertise demonstrated by the RPF (processing more than 2,000 parts in FY13) was critical in meeting the needs for the B61-LEP, W88-Alt, and numerous Work for Others programs. NW (2500)

The Product Realization Integrated Digital Environment (PRIDE) delivered new technology architectures and enhanced services enabling the mission of NW across the National Security Enterprise (NSE). PRIDE enhancements created efficiencies for Engineering Authorizations by enhancing the EAWeb and NSEHub applications. Improved capability and usability of the Integrated Surveillance Information System allows users to analyze surveillance data in combination with corresponding tester data. Upgrades made to classified and unclassified PDM-Link services now enable a major upgrade to Pro/E (CREO) in FY14. NW (9500, 2900)

The National Security Quality Training (NQT) program trained more than 600 engineers and other Labs staff during FY13. NQT courses provide insight and training on how to promote superior product quality by preventing defects at each step of the product realization process, from requirements development to design qualification to supplier engagement. The NQT program directly supports the B61-12 LEP, which has promoted these defect-prevention methods, and sent most product realization team members through the course NQT102 "Using Fagan Inspections to Remove Defects from Product Definition" and improved requirements documents and qualification plans. NW (400, 2900, 10200, 10500)

A Sandia neutron tube team met and/or exceeded all FY13 production yield and build start capacity requirements. The FY13 production yield doubled over 10 consecutive months through systematic application of continuous improvement principles to production processes, physical observations, and the formation of a high-functioning production team. The build start capacity increased very substantially by qualifying new equipment, implementing visual management systems, and workflow optimization. NW (2700, 2500)

Global security

Mobile Radiation Detection and Identification System at the Port of Oman. (Photo by Greg Stihel)

Sandia completed development, delivered, and ensured successful operation of a second-generation Mobile Radiation Detection and Identification System (MRDIS) to the Port of Oman. This technology makes it more difficult to sneak illicit radiological materials into the US or partner countries via transshipment of cargo containers. The MRDIS system does not interfere with normal port operations and does not delay cargo, which makes the technology appealing and cost-effective. The work was funded by NNSA's Second Line of Defense Program in partnership with Pacific Northwest National Laboratory and with the Cincinnati firm DRS Technologies. IHNS (6800)

Radiation Protection provided Radiological Control Technician Training for personnel from various Iraqi ministries, all of whom are involved in dismantling Iraq's nuclear complex or the control of radioactive sources throughout Iraq. The four-week event strengthened Iraq's radiation protection knowledge, skills, and abilities, and improved internal capabilities for providing effective radiation safety and regulatory oversight of the use of nuclear/radioactive materials, decommissioning Iraq's nuclear facilities, and managing radioactive waste. The training was sponsored/funded by the US Department of State, International Atomic Energy Agency, and the US Nuclear Regulatory Commission. IHNS (4100, 6200)

In the US, the Select Agent Program (SAP) regulates facilities that work with a list of dangerous pathogens. The regulations require facilities to implement appropriate biosafety and biosecurity based on a risk assessment, but until now there has been no guidance from the regulators on how to conduct the needed risk assessments. On Dec. 1, 2012, SAP linked to the LDRD-funded Biological Risk Assessment Methodologies (BioRAM) tools developed by Dept. 6822. These tools are also now used by laboratories around the world. IHNS (6800)

Under the 1993 US-Russia highly enriched uranium (HEU) Purchase Agreement, **Russia converts HEU from dismantled nuclear weapons into low enriched uranium (LEU) for use in US civilian nuclear reactors**. The HEU Transparency Program monitored the Russian HEU-to-LEU conversion process to ensure compliance. As the program's technical lead laboratory for tamper-indicating devices, Sandia deploys and verifies the integrity of the devices. The major milestones (downblending 500 MT of HEU and delivery to the United States of all LEU produced) of this landmark 20-year nonproliferation program are scheduled to be completed this year. IHNS (6800)

During a Joint Working Group international test, **a Sandia team showed that solids released from illicit nuclear production can be recognized long after release** if one knows which chemical forms they convert to. The test occurred at a UK nuclear facility with six DOE laboratories and the UK's Atomic Weapons Establishment and Ministry of Defence. The team coupled knowledge and modeling of the chemical effluent reaction pathways with an understanding of the product spectroscopy. This allowed successful prediction of observed materials and signatures before the test began. DSA (8100, 8600, 6200).

NANCY JACKSON

Nancy Jackson (6823) in 2007 helped the US Department of State create the Chemical Security Engagement Program to help scientists around the world, particularly in developing countries, keep chemical use safe and secure.

Nancy and her team develop and implement programs for laboratories worldwide to help manage their chemical inventories and devote time to training future laboratory trainers.

As the 2011 president of the American Chemical Society and manager of Sandia's International Chemical Threat Reduction program, Nancy has traveled and worked closely with scientists in some of the world's most volatile regions to make their laboratories more safe and secure.

For her extensive work engaging scientists around the world, the American Association for the Advancement of Science honored Nancy with the 2013 Science Diplomacy Award at the 2013 AAAS annual meeting in Boston.

"Nancy has been a true pioneer in chemical threat reduction work globally. Even though the chemical threat has not received all the attention that the biological threat has, the ubiquity of dangerous chemicals and the means to misuse them makes the danger of chemical terrorism and proliferation just as clear and present as the biological threat," says Ren Salerno (6820), senior manager of Sandia's International Cooperative Threat Reduction program. "The recent crisis in Syria emphasizes this reality. The work of Nancy and her department is unquestionably a critical Sandia contribution to US and international security."

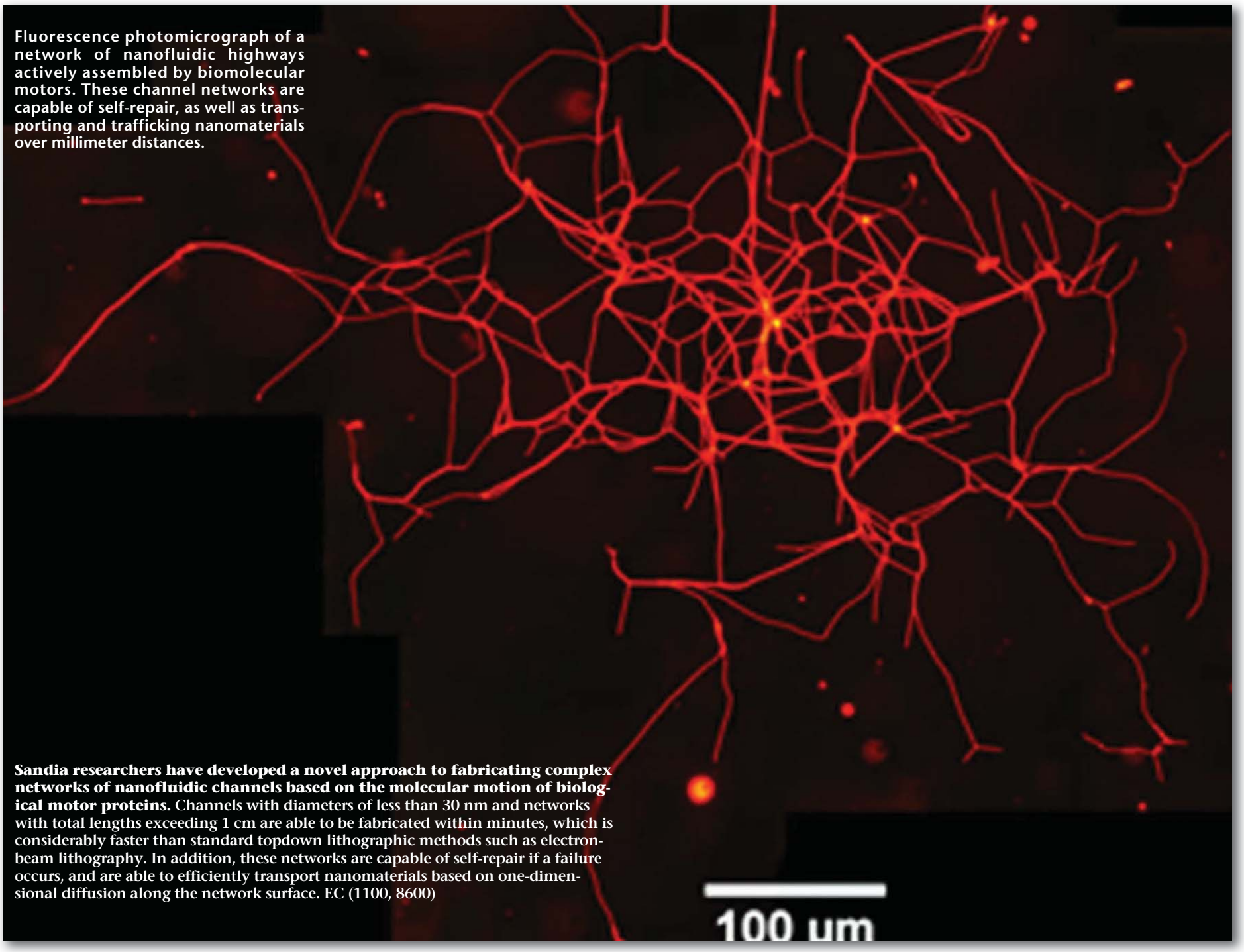
Despite the important national security mission of Nancy's work, she says one of the most rewarding aspects of her job is building relationships, particularly with the growing population of female chemists and chemical engineers in the developing world.

Infrastructure security

With its Veterans Emergency Management Evaluation Center and Cornell University partners, Sandia created hospital evacuation models that support hospital administrators. These models identify strategies that reduce patient risks by increasing the speed and efficiency of evacuations despite loss of power and other infrastructure. The team used the model to study how additional staff and resources could have facilitated or rendered unnecessary the evacuation of Hermann Memorial Hospital in Houston during the 2001 Tropical Storm Allison. Future work includes studying the Superstorm Sandy evacuations. IHNS (6900, 6100).

Aerial views during an Army search-and-rescue mission show damage from Hurricane Sandy to the New Jersey coast, Oct. 30, 2012. Sandia has created hospital evacuation models to aid hospital administrators during crisis situations that may involve loss of power and other critical infrastructure. (US Air Force photo by Master Sgt. Mark C. Olsen)

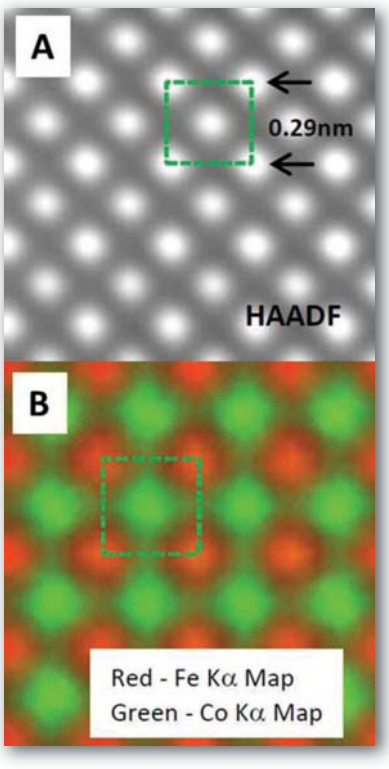
Materials



Fluorescence photomicrograph of a network of nanofluidic highways actively assembled by biomolecular motors. These channel networks are capable of self-repair, as well as transporting and trafficking nanomaterials over millimeter distances.

Sandia researchers have developed a novel approach to fabricating complex networks of nanofluidic channels based on the molecular motion of biological motor proteins. Channels with diameters of less than 30 nm and networks with total lengths exceeding 1 cm are able to be fabricated within minutes, which is considerably faster than standard topdown lithographic methods such as electron-beam lithography. In addition, these networks are capable of self-repair if a failure occurs, and are able to efficiently transport nanomaterials based on one-dimensional diffusion along the network surface. EC (1100, 8600)

Sandia has used atomic-scale X-ray mapping to directly image the structure of an intermetallic alloy with similar atomic number. Using a newly developed technique that allows imaging at a much-reduced electron dose on our Aberration Corrected Scanning Transmission Electron Microscope, Sandia was the first lab able to unambiguously determine the exact atomic structure of an iron cobalt alloy (lattice spacing of 2.9Å) previously unresolved. This advanced capability is applicable to a wide range of alloys of interest for Sandia missions. LDRD (1800)



Due to their similar electron scattering power, Fe and Co atoms are indistinguishable in the high-angle annular dark field image (A) of the Fe/Co intermetallic alloy. A composite color map based on collected characteristic X-rays (B) clearly shows the ordered arrangement of Fe and Co in the structure.

Bioscience

(Photo by Stephanie Blackwell)

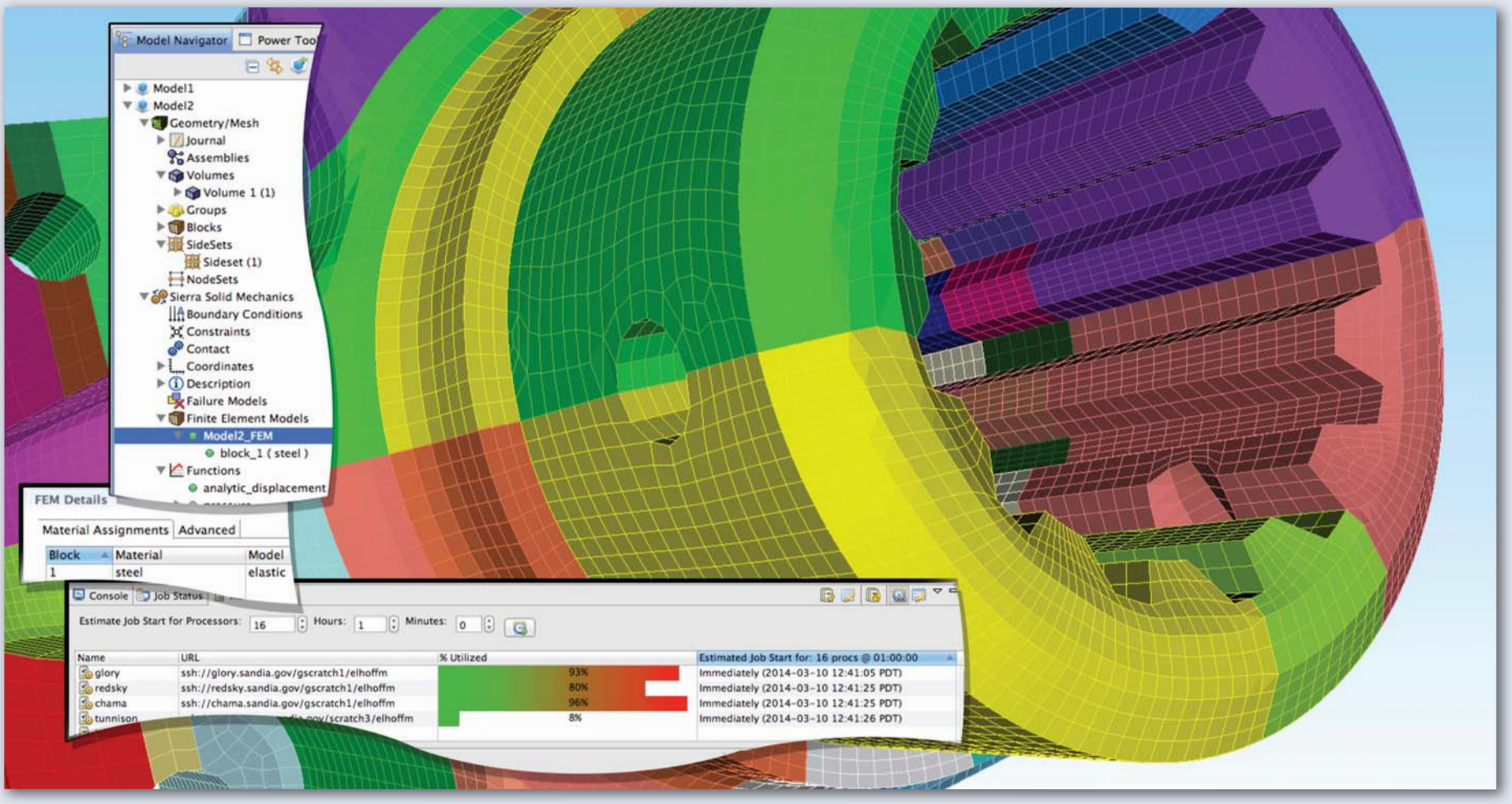
CONRAD JAMES

Conrad James was appointed by New Mexico Gov. Susana Martinez and confirmed by the New Mexico State Senate to a six-year term on the Board of Regents at the University of New Mexico. Previously, he served a two-year term in the N.M. House of Representatives. Conrad was recently invited to attend the 2013 EU US Frontiers of Engineering Symposium in Chantilly, France, organized by the US National Academy of Engineering and the European Council of Academies of Applied Sciences, Technologies, and Engineering, where he spoke on nanobiosensors. During his Sandia career, Conrad has been the principal investigator of numerous biotech projects including microfluidic biosensors and neuromorphic computing. He currently leads a DHS-sponsored microfabrication effort to develop a medical diagnostic sensor, the largest biosensor effort to be carried out in Sandia's MESA facility.

Sandia researchers at the Joint BioEnergy Institute have reported the first demonstration of a one-pot, wash-free, process for the ionic liquid pretreatment and saccharification of switchgrass. The Sandia team was able liberate 81.2 percent glucose and 87.4 percent xylose and separate them at better than 90 percent efficiency. This process eliminates the excessive use of water and waste disposal associated with ionic liquid pretreatment, drastically simplifies the downstream sugar/lignin recovery process, and enables the ionic liquid to be recycled, all factors that help drive down biofuel production costs. EC (8600)

The right combination of enzyme cocktail and ionic liquid pretreatment can be used to extract fermentable sugars from switchgrass in a single, wash-free step.

Computer & information sciences



The Sandia Analysis Workbench interface provides a new information-rich integrated model-building environment to streamline analysis workflows.

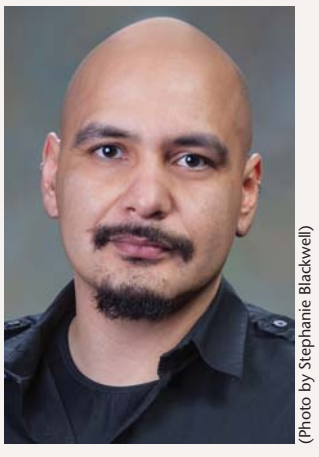
Researchers have developed a novel, integrated model-building software application for computational simulation. By combining their established best-of-breed meshing, geometry, and model-building tools with a uniquely innovative model attribution mechanism and dynamic input deck synchronization, workflows are streamlined, making analysts more efficient. The first official release of this software, the Sandia Analysis Workbench, provides an intuitive interface that is accessible for new users and singularly productive for power users. Creating complex multi-physics simulations is now easier and less error-prone. DSA, NW (1500, 8900)

The Automated Expertise Identification Application enables people around the Labs to more easily find materials experts. Text analytics was used to automatically map LDRD and SAND Report abstracts to appropriate categories in the Sandia Category Guide. A user interface was developed for displaying the expertise results. This addressed the need to inexpensively gain current knowledge of the skills and competencies in the Labs, and is a resource to rapidly adjust to changing national security needs. (1800, 9500, 7900)

The Hybrid Methods in **Cybersecurity Analysis LDRD (FY11-FY13) developed the Hybrid Toolkit, which leverages off-line data analytics** to generate mathematical models used to process real-time cyber data. Sandia's Enterprise Security incident response team uses the Hybrid Toolkit to analyze network traffic, email, and other cyber datastreams to enhance situational awareness of emerging threats. The Hybrid Toolkit's generalized architecture facilitates the integration of innovative data analysis research into production environments, which enhances research impact and increases the agility of cyber analysts. LDRD (1400, 5600, 9300)

Phase II of work by Software Systems Research & Development to model wind turbine equipment failure provided insights into characteristics indicative of impending failures within a five-day window. In addition, unsupervised modeling of wind turbines based on eight months of performance data revealed multivariate similarities for wind turbines that will experience near-term equipment failure. This effort is part of an ongoing collaboration with Wind Energy Technologies. Enterprise Database Administration developed and maintains the wind turbine database. EC (9500, 6100)

Xyce, Sandia's SPICE-compatible parallel circuit simulator, has been released publically as open source software. Xyce, developed at Sandia and funded by the Advanced Simulation and Computing (ASC) Campaign, is a modern circuit simulation application. It supports a canonical set of SPICE models and analysis methods. In providing Xyce to the external community, Sandia contributes a robust and modern electronic simulator to users and researchers in the field and hopes to foster collaborations and feedback to further improve Xyce's usability, performance, and robustness. NW (1300)



(Photo by Stephanie Blackwell)

EDWARD JIMENEZ

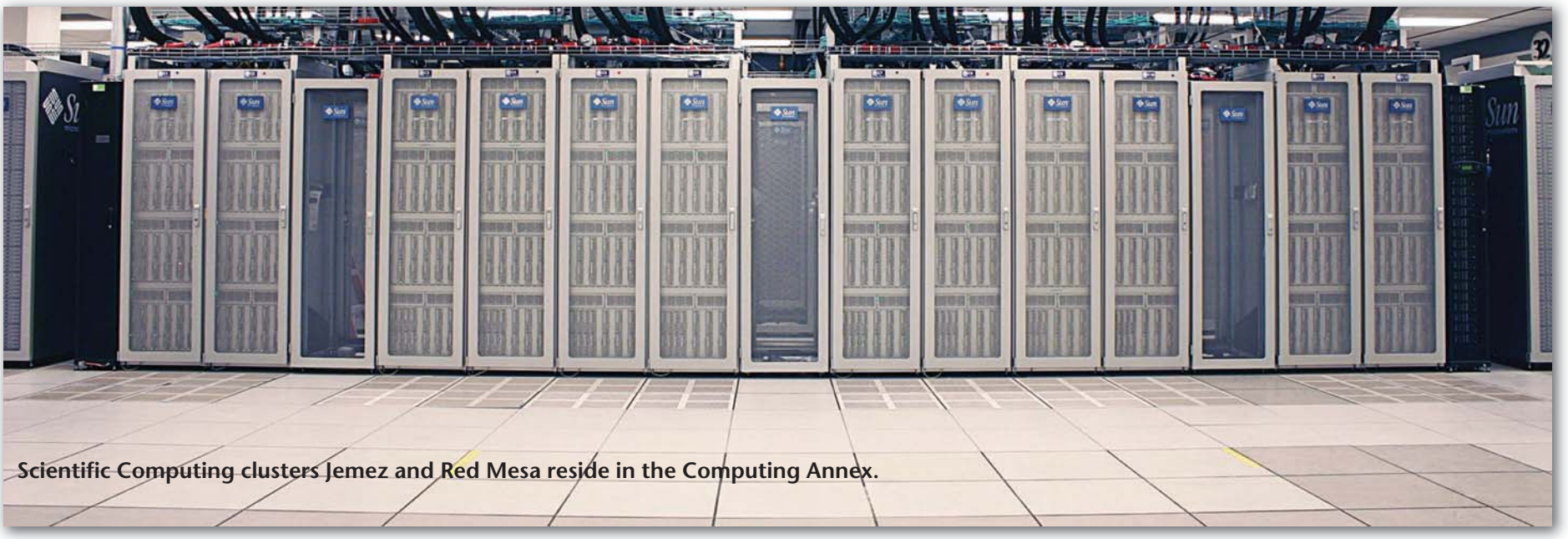
Edward Jimenez has conducted Early Career research in Computed Tomography and High Performance Computing. As a result, calculations that traditionally required months or years to complete now require less than 24 hours and are up to 35 times more energy-efficient. His research has produced six scientific papers and four technology advances. Additionally, Edward has taken the initiative to bring in underrepresented students to intern at Sandia. Edward is currently mentoring a female computer science PhD student and an applied mathematics undergraduate intern from the Minority Access to Research Careers program. Edward routinely speaks to at-risk and incarcerated youth, high school, and college students in predominately Hispanic neighborhoods to encourage them to pursue a higher education in mathematics, science, and engineering. Edward serves on a Program Committee for the International Society for Optics and Photonics and is a peer reviewer for the American Society for Nondestructive Testing.

Mark Boslough (1442) and Brad Carvey (1460) like to make science cool. **Their latest collaboration showcased Mark's model of the recent explosion of an asteroid in Russia**. Mark was one of the first western scientists to travel to Chelyabinsk, where he collected data to help determine the trajectory to initialize his model, now published in the journal *Nature* (Nov. 14). The highly regarded science publication highlighted Mark's simulation on the cover, using an image rendered by Brad, and in a video released to the media. LDRD (1400)

Draft cover of the Nov. 14, 2013, issue of Nature. Brad Carvey (1460) endered a 3D simulation of the Chelyabinsk airburst by Mark Boslough (1442) using the CTH code on Sandia's Red Sky supercomputer.

(Foreground photo by Olga Kluglova).

IT, networks, & facilities



Scientific Computing clusters Jemez and Red Mesa reside in the Computing Annex.

Sandia acquired significant scientific computing resources for institutional computing and prepared several existing systems to be redeployed to support this same need. Sandia provided institutional support for a new 90-teraflop cluster named Jemez, and our agreement with the National Renewable Energy Laboratory (NREL) permitted a realignment of the Red Mesa computer system from dedicated NREL use to Sandia programs. All PMUs (9300)

At the 12th Annual Cleaning Industry Awards Banquet, the **Facilities Management and Operations Center custodial team was nominated in seven categories and won Best Audit and Best Cleaning Program**, competing against 15 national institutions/companies. Sandia was recognized for its consistent and highly rated program and was also presented with an (OS1)® Green Certified Cleaning Program Award for meeting the Green Certified Programs of Excellence level by earning an audit score of 93 percent. "Cleaning for health and then appearance," Sandia has won Best Audit six consecutive years. IMS (4800)

The 3CSI program delivered a robust, highly secure virtual desktop capability to the users of Sandia's classified network (SCN). This capability transitioned from pilot mode to production in FY13 and is currently used by approximately 300 users as their main access to Sandia's classified computing resources. For many of these users, their boot times were reduced from 3 minutes, on average, to 15 seconds, significantly improving the efficiencies of the users. NW, others (9300, 9500, 8900)

Working within a newly defined corporate governance structure, the **Common Engineering Environment (CEE) IT Integration Team made additions to what is shaping up to be a suite of supported tools**, both technical and information management, in Sandia's CEE. Additions included tools for earned value management (Primavera), requirements management (DOORS), and electrical circuit simulation (PSPICE). While doing so, the team worked to integrate and leverage existing corporate assets and services in ways that promote efficiencies and lay foundations for future delivery of additional CEE services. All PMUs (9000, 9300, 9500)

(Photo by Stephanie Blackwell)

LYNNWOOD DUKES

Lynnwood Dukes has been a member of the Energy Facilities Contractors Group (EFCOG), a consortium of DOE contractors formed to represent the field element on DOE issues, for 15 years, and recently served as chairman of the Infrastructure and Sustainability Working Group. In this capacity Lynnwood has led many initiatives in support of continuous improvement in the areas of facilities, infrastructure management, energy management, and sustainability. Lynnwood has provided exceptional service to the nation through his many years of leadership within EFCOG and support to the DOE.

The Network Revitalization Project, completed June 2013, is a comprehensive end-to-end redesign of Sandia's unclassified networking and communications architecture using Gigabit Passive Optical Networking (GPON) technology, ensuring Sandia's status as an industry leader for being one of the first large enterprise implementations of GPON technology. GPON provides voice, video, and data over a single infrastructure to more than 14,000 locations across the Sandia Albuquerque site, reducing projected costs by $20 million and power consumption costs by over $100,000 annually. IMS (9300)

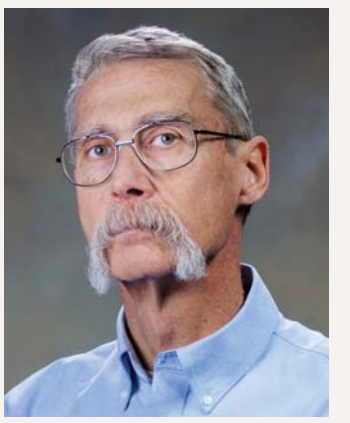
STEVE GOSSAGE examines fiber optic connections in a cable box that replaced older, bulky copper cabling. Sandia's blazingly fast new fiber optic local area network was recognized by *Popular Science* with a 2013 Best of What's New Grand Award. (Photo by Randy Montoya)

Partnerships & alliances

Sandia received two Federal Laboratory Consortium (FLC) national awards. Paul Hommert was named Laboratory Director of the Year for his leadership of the Labs' technology transfer efforts. The Award for Excellence in Technology Transfer went to Sandia and Honeywell UOP for crystalline silico-titanates, which are being used for cleanup of radiation-contaminated water at Japan's Fukushima nuclear power plant. The FLC is a network of federal laboratories that provides the forum to develop strategies for linking laboratory technologies with the marketplace. All PMUs (7900, 6900, 1100, 1)

Through the Laboratory Partnership with Small Business Tax Credit Act, the state of New Mexico and Sandia invested $2.3 million helping 196 small businesses in 27 counties. These businesses created and retained 275 jobs. Small businesses aided by the New Mexico Small Business Assistance (NMSBA) program include a company converting wave power into electricity, an art studio, a respiratory therapist, and a children's shoehorn company. NMSBA assists for-profit small businesses in NM to access cutting-edge technologies, solve technical challenges, and gain knowledge from laboratory experts. All PMUs (7900, 1500, 1800, 400, 2100, 2500, and 1800)

Legal hosted a lean six sigma event to streamline the non-disclosure agreement ("NDA") process. The outcome was the creation of a Pre-Approved NDA Template. When the line needs to exchange confidential information with a partner, they simply check with Legal to see if an agreement already exists. If no agreement exists, the line completes the Pre-Approved NDA Template and sends it to the partner for signature. If the partner needs to modify the agreement the line negotiates the changes, coming to Legal when advice is needed. IMS (11500)



STEVE GOSSAGE

Steve Gossage led Sandia's Network Revitalization Project efforts to install the world's largest enterprise passive fiber optic local area network, with high-speed connections for 265 buildings and 13,000 end-users, each with a hookup capable of 1 gigabit per second. Sandia's fiber optic network won *Popular Science's* Grand Award for Engineering when the magazine released its Best of What's New 2013 winners. Steve led the technology research, architecture, and design as well as supported a larger team to install the new network. In addition, Steve was interviewed by the *Green Room* about gigabit passive optical networking and the segment was aired on Fox Business news earlier this year. During his distinguished 37 year career at Sandia, Steve has helped integrate many new technologies into Sandia's corporate computing environment. In his current role as a Senior Engineer, Steve applies his experience and technical expertise to continually shape networks and systems for our corporate IT environment. Steve is currently investigating the deployment of next-generation XG-1/XG-2 passive optical networks.

Supply chain

Sandia is developing for the Department of Homeland Security (DHS) risk models, risk management strategies, and risk evaluation tools for use in advising federal government agencies regarding risk incurred from acquisitions of information technology products and services. These efforts support the development by DHS of a robust capability for characterizing, quantifying, and mitigating supply chain risks relevant to the US government. IHNS (8100, 8900)

Procurement developed a unique and different approach for quotation time for the B61-12 program, where work begins upon issuance of an unfunded task using Sandia's estimate, while in parallel a formal quotation is developed by Kansas City Plant. Given the cost-no fee environment, this approach saves more than a month per task, has minimal risk, and has had a tremendous positive impact on the mission customer. NW (10200, 10600, 2100)

Sandia's participation in NNSA's Supply Chain Management Center (SCMC) was noted for successfully contributing more than $35 million in site strategic savings for FY13. Of the seven Nuclear Security Enterprise sites participating in the SCMC, Sandia's contribution alone accounted for 70 percent of the total site strategic savings reported. In addition to successfully meeting SCMC savings objectives, Sandia exceeded each of the SCMC goals for FY13 and was commended for effective use of the SCMC tools. IMS (10200)

Military programs

Brett Bagwell (5331) demonstrates the RAZAR riflescope to Adm. William H. McRaven, commander, USSOCOM.

Brett Bagwell is a subject matter expert to US Strategic Operations Command (USSOCOM) on optics and visual augmentation systems. He led the development of Sandia's Rapid Adaptive Zoom (RAZAR) riflescope, which is being nominated for an R&D 100 award. Brett's technical advice was also instrumental in the success of developing the Standoff Anemometer, the Modular Sniper Display, the CQBSS riflescope, and numerous advanced night vision devices. He has been given the lead role in USSOCOM's Sniper Wind Sense development for long-range shooting, which has become a Coalition Warfare Program. DSA (5300)

Information Systems Analysis Center 5600 partnered with the Army's Network Enterprise Technologies Command (NETCOM) to help secure Army networks. Conventional network defenses issue alerts when they recognize digital signatures from past attacks, leaving a defender vulnerable to new techniques. Sandia-deployed technology searches for suspicious behaviors, helping the Army detect sophisticated adversarial attacks in their networks and exercises. In two days Sandia deployed remote sensors and shipped data to Army and Sandia response centers. NETCOM leadership recognized Sandia's impact and tripled the scope of this work for FY14. DSA (5600, 9300)

The Portable Airborne Interrogator Transponder System (PAITS), successfully fielded since 2006, has been a longstanding Special Operations Forces workhorse system that has been used in countless missions. Sandia is routinely called upon to provide technical consultation and support for the system. Several deliveries have been made to the Special Operation Forces Community since the system's inception to support airborne and ground-based operations and the system has continued to evolve to meet constantly changing real-world threats. During a recent visit by Adm. William McRaven, commander of US Special Operations Command, he presented an achievement award to the PAITS team. DSA (5300)

CHAMP (Counter-Electronic High Power Microwave Advanced Missile Project) is **the nation's first weaponized high-power microwave system**. Developed in conjunction with the Air Force Research Laboratory, Boeing, and Raytheon Ktech, CHAMP provides the warfighter with a unique nonlethal alternative that may ultimately save lives in future conflicts. The success of the CHAMP flight test indicates that the technology is a viable solution with tremendous military utility. DSA (5400)

Sandia's Kauai Test Facility (KTF) supported the Missile Defense Agency's FTM-20 mission in February 2013, FTM-19 mission in May 2013, and the FTM-21 mission in September 2013. KTF provided launch support for ballistic missile targets that were intercepted by the MDA's Aegis weapon system. The September launch was attended by Labs Director Paul Hommert as part of a wider tour of KTF. KTF supports the Missile Defense Agency Ballistic Missile Test Program, the Conventional Prompt Global Strike Program, and other Navy flight test programs. NNSA recently recognized KTF as an "important NNSA facility for testing activities" and rescinded a 2009 decision to excess the site. DSA (5400)

Sandia worked closely with the US Army and other organizations to develop the Capability Portfolio Analysis Tool (CPAT). This advanced combination of software tools and methods can be used to analyze countless what-if scenarios. CPAT helps the nation's top generals and senior executives decide on the optimum portfolio mix of vehicles to modernize given the needs for future warfighting capabilities in light of varying budgets and time limitations. CPAT won the 2012 Military Operations Research Society's Richard H. Barchi Prize. DSA

Army Paladin at firing range — The US Army is planning to modernize this fleet of combat vehicles. (US Army Photo)

A Sandia team played a crucial role in demonstrating the need for a program office focused on Contingency Basing management. The team used Sandia's System of Systems Analysis Toolset to develop simulation models that demonstrated the benefits of system-of-systems engineering for contingency base design and operations. In August 2013 the assistant secretary of the Army for Acquisition, Logistics and Technology chartered the establishment of the Product Directorate for Contingency Basing Infrastructure in large part due to Sandia's analysis. DSA (6100)

Sandia, collaborating with external partners, has demonstrated an atomic clock with an unprecedented combination of stability, size, and power. The clock varies less than 160 nanoseconds a month — exceptional timing stability in a device roughly the size of an apple and consuming only 0.5 W, with orders of magnitude better performance per size than present systems. The Sandia team was the only performer on DARPA's IMPACT project to achieve the program goals. The clock has the promise to significantly miniaturize navigation and communication systems. DSA (1700/Draper Labs/Symmetricon)

Supporting the Air Force Research Laboratory (AFRL), Sandia has developed an initiation system capable of being embedded within the main explosive charge of a weapon system. This first-of-a-kind experimental system, called the Distributed and Embedded Firing System, was designed, developed, tested, and delivered under a rapid development contract. The project proceeded from concept to fully functional inert and explosive prototypes in less than six months and has been successfully tested by AFRL for shock survivability and initiation reliability. The technology is being transitioned to the US Army Armament Research, Development, and Engineering Center in Picatinny, N.J., to enable manufacturing readiness. DSA (2600, 2500, 1800)

Homeland security

KATHERINE GUZMAN

Katherine Guzman (8112) was named a 2013 Luminary by the The Hispanic Engineer National Achievement Awards Corp. (HENAAC). Luminary honorees represent professionals in science, technology, engineering, and mathematics who initiate, collaborate, and lead key programs and research in their companies. These individuals have made significant contributions to the Hispanic technical community as leaders and role models.
At Sandia, Katherine has distinguished herself with her work in the area of risk management. She played a key role in the development of SUMMIT (Standard Unified Modeling, Mapping, and Integration Toolkit), a new technology to enable emergency management personnel — emergency responders and decision makers — to seamlessly access information from diverse models and data coming from different sources. The creation of these tools is now enabling the Department of Homeland Security (DHS) to rigorously plan for and exercise against highly complex disaster scenarios, including detonation of an improvised explosive device in a major metropolitan area, a major earthquake in regions with multiple intersections with critical infrastructure, and a national-level cyberattack.

The Radiation Protection Sample Diagnostics (RPSD) Laboratory was selected to participate in the first Department of Homeland Security-sponsored radiological exercise. To support the exercise, RPSD developed a rapid radioanalytical technique to quantify strontium and plutonium in air filters and soil, enabling decision makers to accurately make recommendations of evacuation zones, food quarantines, and human reoccupation. Sandia received a permit from the US Department of Agriculture to accept international soils. This permit allows Sandia to provide soil-related radiological analysis for international events such as occurred at Fukushima-Daiichi. DSA, EC, IHNS, NW (4100)

Sandia is testing the next generation of cybersecurity technologies to help protect government networks and the nation's critical infrastructure. The Department of Homeland Security Transition to Practice program has White House support to assist in transitioning cybersecurity technologies developed through federally funded R&D into broader utilization. Sandia is supporting this effort with independent performance and security evaluation of candidate technologies, including testing in enterprise-scale emulated cyber networks, operational testing, and red teaming. Sandia is also providing candidate cybersecurity technologies, which are being independently evaluated. IHNS (8900, 5600, 9500, 8100, 8500)

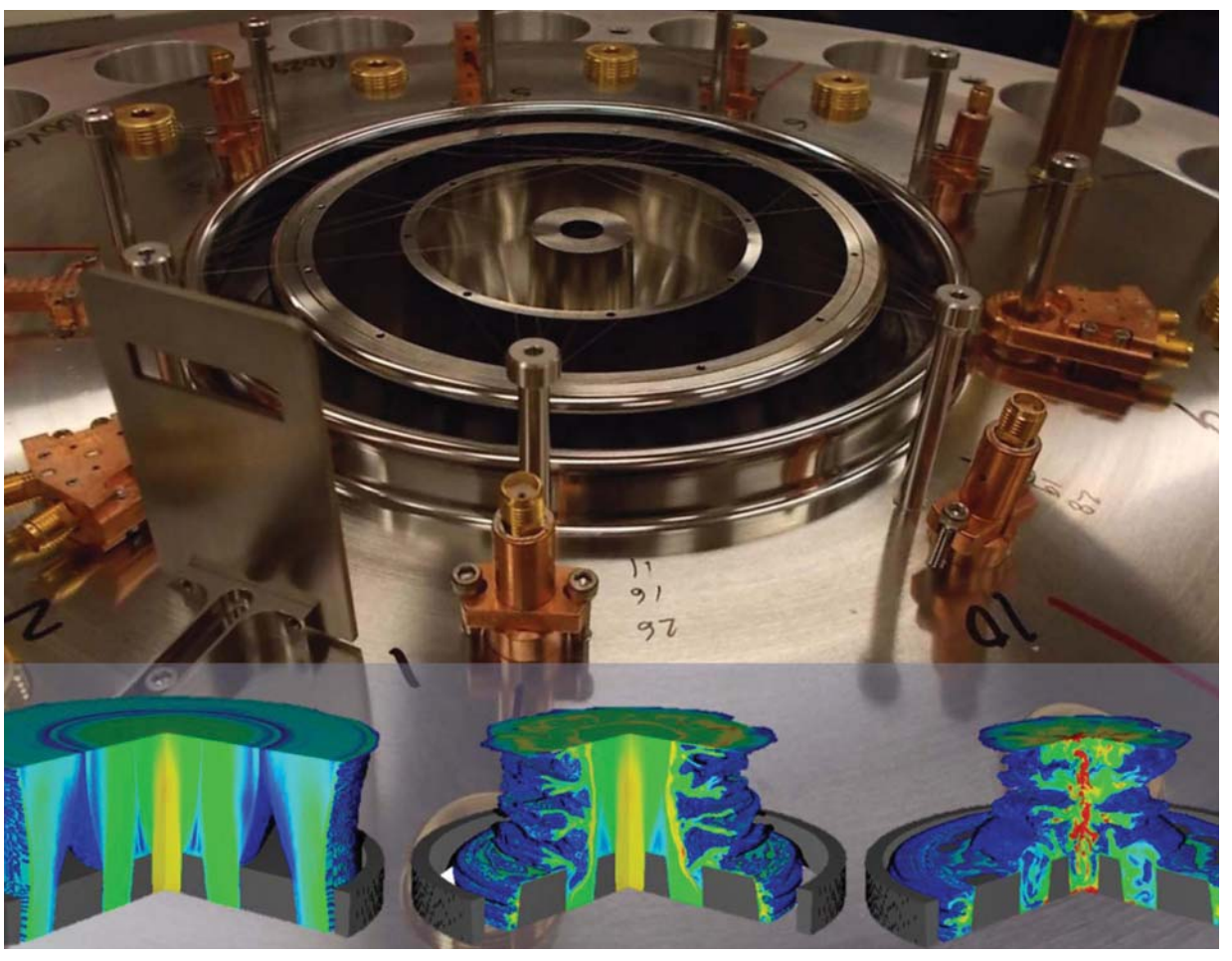
Sandia completed a two-year development, demonstration, and testing program known as the Secure Transit Corridor Program for the Department of Homeland Security Science and Technology Directorate in partnership with Customs and Border Protection (CBP), Honda, GM, and Ford to securely track cargo via truck and rail transit from Mexico and Canada into the US. DHS S&T has let a Request for Proposals for additional security and tracking technology and is directing Sandia to develop a data system accessible to CBP and the link between the government system and commercial versions of the tracking system. This approach improves the security of commerce shipments into the US, which represent one-quarter of the US economy. IHNS (6800, DHS S&T)

DHS S&T Program Manager Ken Concepcion installs an iControl lock on a rail shipment for demonstration of the Secure Transit Corridor Technology from Mexico to the US.

Pulsed power

Sandia physicist Tom Awe (1688) examines coils that reduce plasma instabilities in the quest for controlled nuclear fusion at Sandia's Z machine. (Photo by Randy Montoya)

Recent experiments on the **Z facility achieved record X-ray emission from argon (3 kiloelectron volts) and krypton (13 kiloelectron volts) gas-puff z pinches.** The experiments support Sandia's radiation effects testing mission for stockpile stewardship. Hydrodynamic models were developed to design the gas flow from supersonic nozzles, which were benchmarked against laser interferometry measurements and used to initiate three-dimensional numerical simulations. These tools enabled the design and subsequent implosion of the largest-diameter z pinches ever fielded on Z, at simulated velocities exceeding 1000 kilometers/second. NW (1600, 5400, 1300)



Supersonic gas puff nozzle for Z experiment. Three-dimensional simulations are used to optimize the z-pinch design for maximum X-ray yield.

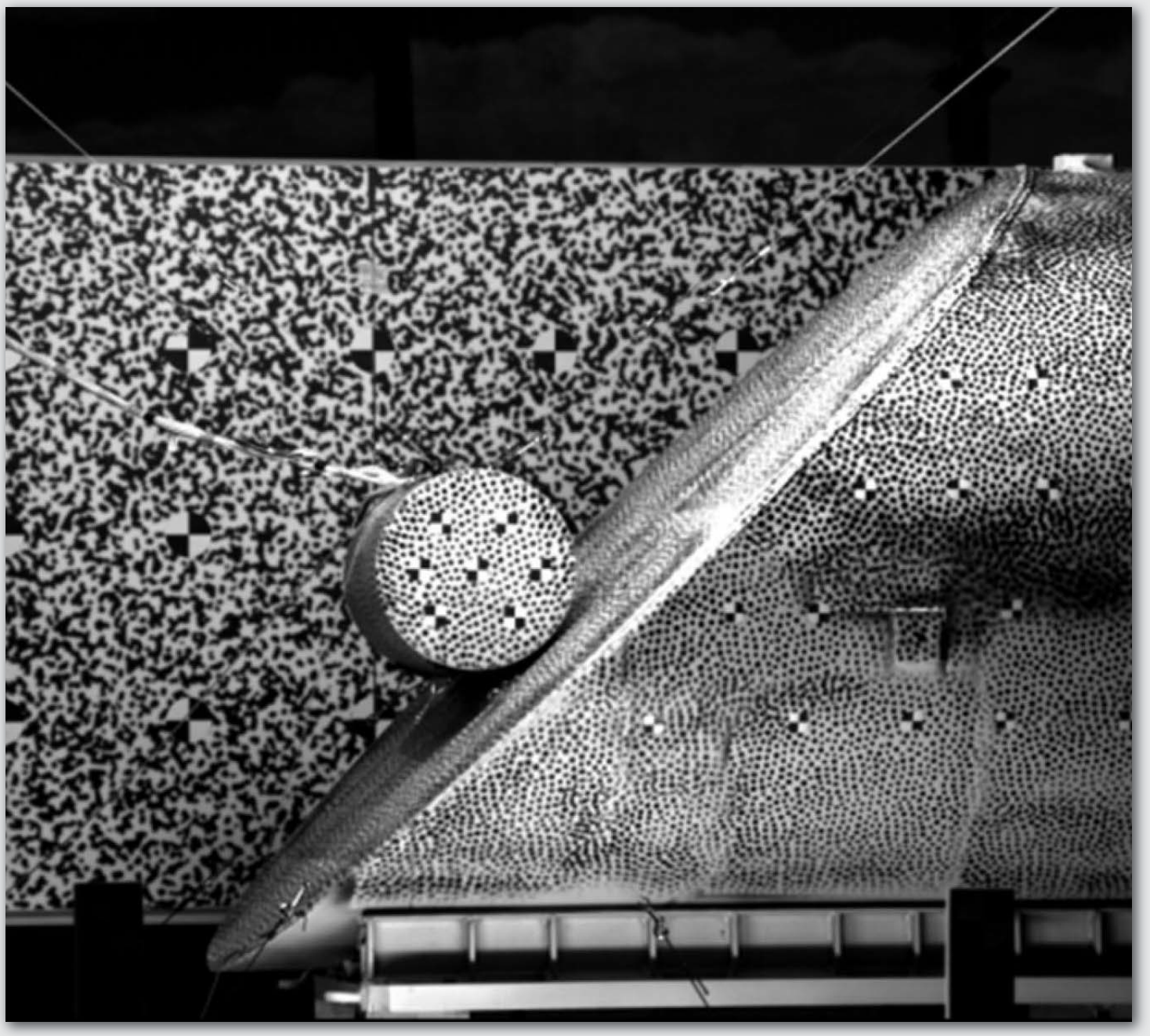
Sandia integrated an applied magnetic field system into the Z accelerator. A 900-kilojoule capacitor bank in the system drives high-field, pulsed electromagnets to pre-magnetize experiments for research in inertial confinement fusion and dynamic materials properties. Fields of 7 to 10 Tesla were attained on more than a dozen Z experiments since February 2013. Our first experiment highlighted the potential to explore new physics when we observed dramatic changes in the implosion dynamics of a fusion target in the presence of the magnetic field. NW (1600, 5400, 4800)

Our plutonium experiments on the Z facility continue to yield new, surprising data about the behavior of the material. On May 15, 2013, we **increased the current delivered by 45 percent, thereby enabling the highest pressure ramp (that is, shockless) compression experiment ever for plutonium.** This accomplishment required very precise pulse-shaping currents. The new data will reduce the uncertainties in complex simulation codes used to assess nation's weapons stockpile. NW (1600, LANL)

Randy McKee (1657) shows a containment chamber used for plutonium experiments on Z.

Engineering sciences

The Sandia Rocket Sled Test Facility had its first active year of tests in a number of years. Most notable was the first sled track test in support of the B61-12 Life Extension Program. A large steel-encased concrete mass was accelerated along Sandia's 10,000-foot rocket sled track to impact a suspended B61-12 test assembly. The data collected in this experiment is used to demonstrate weapon system performance in an abnormal environment scenario while also providing model validation data to the design teams. NW (1500, 2100, 400, 2600, 5300, 4100)



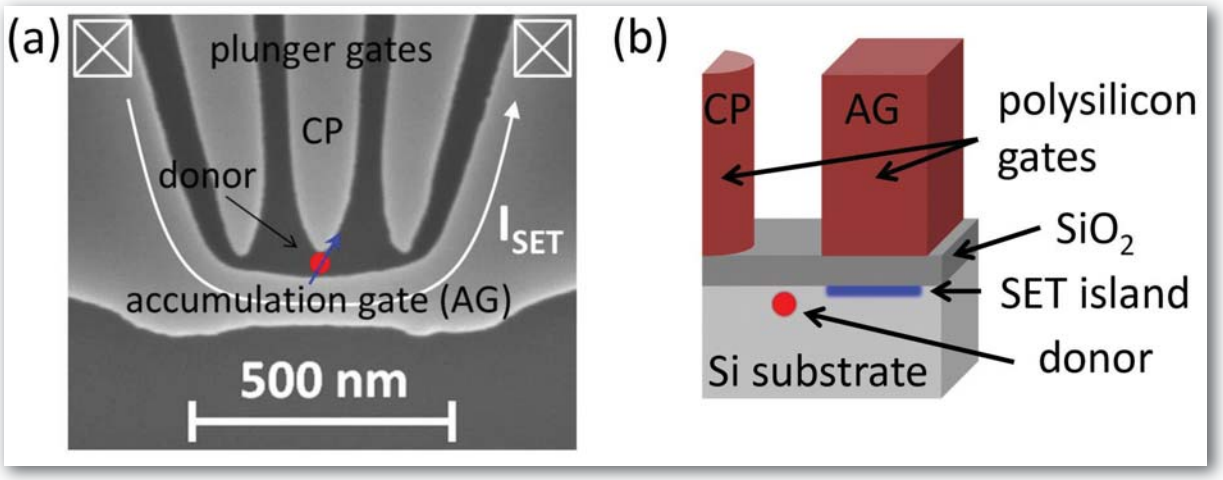
High-speed camera image of a B61-12 test assembly at the moment of impact with the angled face of a fast-moving steel and concrete mass during an experiment at Sandia's Rocket Sled Test Facility.

Sandia researchers have developed a state-of-the art multi-physics capability to conduct 3-D simulations of the functioning electrical wire element in exploding bridge-wire and slapper detonators. Recent simulations have shown remarkable agreement with experimental data. The simulation is adequately capturing the complex physics of the bridge wire rapidly transitioning from a room temperature solid to a high-temperature plasma. Sandia and Los Alamos National Laboratory explosive detonator designers are using this new tool to optimize detonator and firing system performance. (2500, 1400, and 1600)

Modeling and simulation has provided knowledge valued at $73 million for the Neutron Generator Enterprise in FY13. More than 1,200 simulations were run in support of problem-solving activities, including those that enabled meeting the W87 first production unit date. The estimated experimental cost would have totaled $73 million if modeling and simulation were not used to gain the knowledge. The value of the data gained via modeling and simulation was validated against cost estimates from the Pinellas plant decades ago where 519 neutron generators were built and destructively tested to solve a similar problem. NW (2700, 1500, 1800)

Microelectronics & microsystems

One of the leading candidates for a solid-state quantum bit is the spin of a single donor electron in silicon. We have performed the world's first measurement of the electron spin lifetime of a single antimony donor in silicon. The long spin lifetime is promising for quantum computing applications. Our experiment is also the first demonstration of donor electron spin readout using a self-aligned device structure to improve the precision of donor placement. DSA (1100, 1700)



(a) Scanning electron microscope image of device, showing polysilicon gates used to form a Si single electron transistor (SET). (b) Sketch of cross-section of device. The SET is used to sense the spin of an electron on a single Sb donor.

WENG CHOW

Weng Chow (1121) received the 2013 IEEE Quantum Electronics Award "for contributions to semiconductor laser theory, in particular the implementation and verification of many-body effects." His theories led to a greater understanding of observed abnormalities in microcavity lasers such as VCSELs, recognition of the dominance of many-body effects in wide-bandgap lasers, and drastic improvements in accuracy and predictive capability of semiconductor-laser gain calculations. This has raised the scientific presence and stature of Sandia while having significant impact across program areas (NW, EC, and DSA) ranging from the use of semiconductor lasers for direct optical ignition to carrier dynamics in intersubband lasers to solid state lighting and even quantum communication.

Remote sensing


Infrared (false-color) image of the nBn focal plane array development team

We have developed single-chip two-color (short-wave/mid-wave) infrared sensors based on a novel nBn device structure in the Group III-V materials. Compared to the pn diodes in the Group II-VI materials used today, our technology approach offers easier and lower-cost manufacturing, improved array uniformity and signal-to-noise characteristics, and operation at higher temperatures. When fully matured, this technology will provide a leapfrog advance in a wide range of infrared sensing applications contributing to national security. DSA (1700, 5700)

Staff members from Sandia's satellite enterprise successfully developed and implemented a precedent-setting procedure to mitigate the detrimental effects of image artifacts on large-format Focal Plane Arrays (FPAs) installed in sensor systems. Using novel techniques and technical guidance developed in the Detector Lab, an iterative procedure was created to duplicate, characterize, and mitigate these artifacts by adjusting a subset of the hundreds of configurable FPA settings, guided by laboratory-based research and testing results. This new, state-of-the-art approach significantly improved component and system performance. (5500, 5700, 5900, 5300, 1700)

The next-generation Integrated Correlation and Display System (ICADS), a satellite ground system for processing nuclear detonation detection data, has completed all field site testing and was declared operational this year. The system uses a new phased array antenna, spread spectrum receivers, multi-node network computing, and 1.5 million lines of custom software to fuse data from sensor payloads on more than 30 satellites The operational certification culminates a six-year effort by a team of more than 100 people. During the development the team achieved AS9100C quality certification. DSA (5700, 5500, 5300, 2600)

Scientists seeking answers to questions about Arctic climate change will soon have a bevy of new data to mine from the North Slope of Alaska. **In mid-September, a field team led by Sandia finished installing an initial collection of instruments at Oliktok Point, Alaska**, for a new DOE climate observation station. Initial measurements of clouds, aerosols, solar and thermal energy, and standard weather components are already flowing for use by the research community, meeting a critical end of FY13 deadline. EC (6900, 4100, 6000, 4800, 10200)

Sandia teamed with NASA and the Johns Hopkins Applied Physics Lab to produce bistatic synthetic aperture radar images of lunar craters. The images could help predict whether there is ice at the bottoms of craters never illuminated by the sun. The implications of ice on the moon are important for future lunar missions, including colonization and the synthesis of rocket fuel. The radar transmitter used for this effort is the very large dish at Arecibo, Puerto Rico. The receiver, mounted on the Lunar Reconnaissance Orbiter, is built by Center 5300. DSA (5300, 5800)

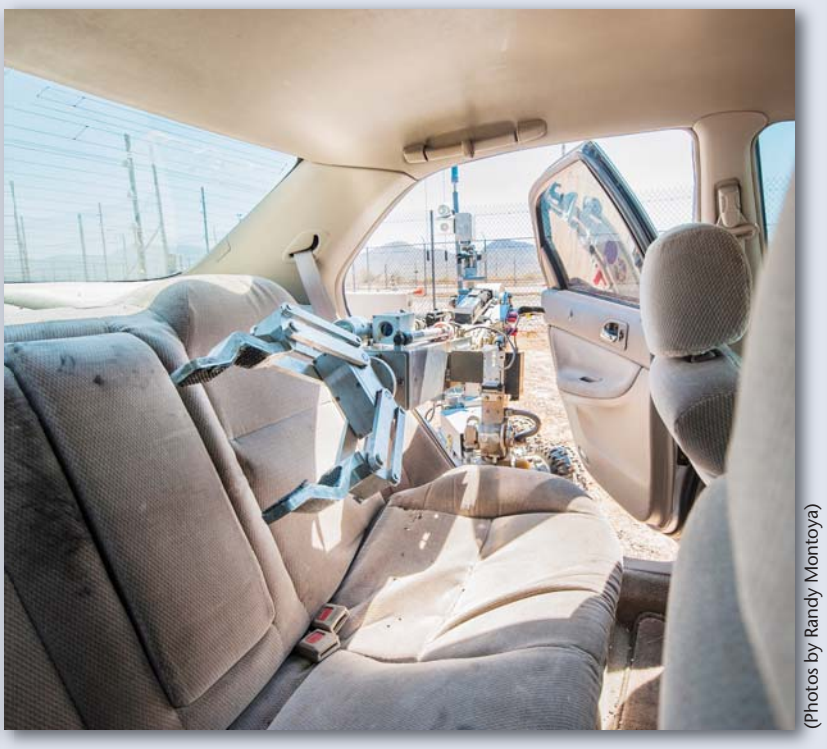

Bistatic image of lunar craters


RYAN PRESCOTT

Ryan Prescott led the United States Nuclear Detonation Detection System (USNDS) Architectures Satellite Ground Segment Impact Study to assess and quantify system-level impacts and cost estimation for the next generation of information and data processing capability for the USNDS. The USNDS has long provided the US capability to detect above-ground nuclear detonations and is preparing for new satellite payloads and new mission challenges. The study consisted of examining multiple ground architectures and included multiple community stakeholders across DoD and DOE. This analysis was part of a larger effort that included system performance of the USNDS and resulted in the delivery of cost and schedule estimates, risk analysis, and briefing for all architectures.

Robotics

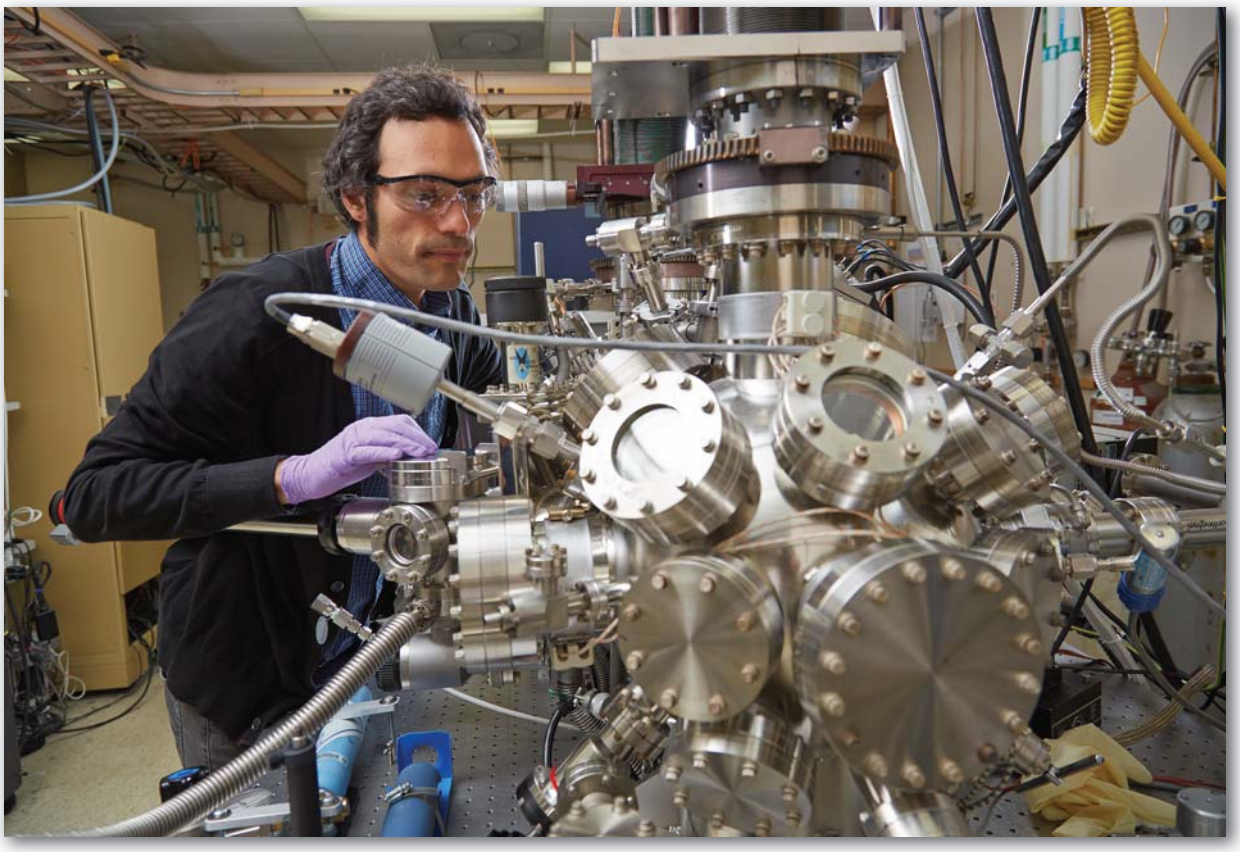
Sandia hosted state, local, and military bomb squads in the 2013 Western National Robot Rodeo and Capability Exercise in June 2013. Several vendors participated, providing teams with hands-on, first-look experience with emerging products and capabilities. In addition, representatives from several Sandia sponsors, including the Technical Support Working Group, the UK Ministry of Defence's Defence Science and Technology Laboratory, National Bomb Squad Commanders Advisory Board, and NNSA's Office of Emergency Response were onsite to identify further opportunities for research and development. IHNS (6500)



(Photos by Randy Montoya)

Energy

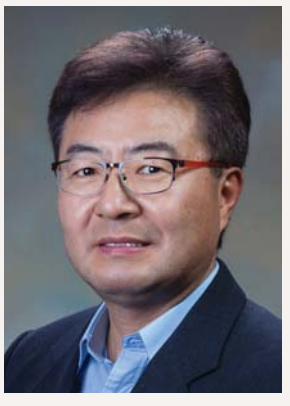
Farid Ed Gabaly (8656) and William Chueh published in the journal *Nano Letters* work on elucidating the particle-by-particle mechanism by which lithium ions move in and out of electrodes made of lithium iron phosphate. Their results were subsequently publicized in *Science Newsline*, *AZoNano*, *Before It's News*, *Clean Technica*, *e! Science News*, *ECN Magazine*, *Nanotechnology Now*, *News Odrome*, *R&D Magazine*, *redOrbit*, *Science Codex*, and *Science Daily*. Ed and Chueh's findings could lead to better performance in lithium-ion batteries in electric vehicles, medical equipment, and aircraft. EC (8600)



Sandia physicist Farid El Gabaly aligns a lithium-iron-phosphate battery electrode sample for chemical characterization with X-ray photoelectron spectroscopy. The samples will then be thinly sliced for state-of-the-art synchrotron X-ray microscopy. (Photo by Jeff McMillan)

Researchers at Sandia are working with the US Council for Automotive Research (USCAR) to develop mechanical models to predict how an electric vehicle battery will react during a crash. Mechanical testing, diagnostics, and analysis of batteries at the Sandia Battery Abuse Testing Laboratory provide experimental validation to models developed at Ford, GM, and Chrysler for USCAR. Information from these predictions is used in battery and vehicle design for next-generation electric vehicles to ensure the safety of these exciting emerging technologies. EC (2500)

Sandia executed a Government Use Notice with CH2MHill for the use of **Sandia-developed technology and patents for a permeable reactive barrier to prevent a radioactive strontium plume in soil** on the Hanford site from reaching the Columbia River. The barrier was first piloted in 2007 and its demonstrated success in preventing strontium from reaching the river has led DOE to extend the barrier emplacement along a stretch of river from the initial emplacement of 300 feet to more than 1,000 feet. EC (6900, 7900)



BYOUNG YOON PARK

Byoung Yoon Park's (6914) paper on the interface analysis for the Big Hill Strategic Petroleum Reserve (SPR) site won the best paper award at the 47th US Rock Mechanics Symposium held in San Francisco in June 2013. His numerical simulation of interface movements between different lithologies in wellbores at Big Hill explained the root cause of the oil leaks to the DOE customers. The interface modeling technique elaborated in the winning paper will have lasting impact on predicting wellbore failures and maintaining the performance of other SPR caverns.

Unique tests of a surrogate nuclear fuel assembly were performed on a Sandia shaker table to replicate vibration and shock loadings inherent in over-the-road truck transport. There are DOE and regulatory concerns that high burn-up used fuel rods may fracture during normal conditions of transport. These tests demonstrated that strains induced on the fuel rods are very low, suggesting that failure of the rods during routine truck transport is unlikely and that high burn-up fuel can be transported safely. EC (6200, 1500)

Would it be best for the US to have a "one-size-fits-all" repository for nuclear waste, or should there be more than one? **Sandia developed a technical basis to inform policy strategies for the permanent geologic disposal of spent nuclear fuel** and high-level radioactive wastes in the US. Relevant policy questions addressed include: Is a one-size-fits-all repository a good strategic option for disposal? Do different waste types and forms perform differently enough in different disposal concepts that they warrant different treatment? The study evaluates potential impacts of waste forms on the feasibility and performance of representative generic geologic disposal concepts. EC (6200, 6600, 6800)

Sandia is nearing completion of a feasibility study to develop a 130MW microgrid sufficient to power the New Jersey transit system of electric trains reaching into Manhattan, neighboring train systems, and sell excess power to PJM. The highly reliable microgrid system is estimated to cost several hundred million dollars with a high probability of successful financing. It will include state-of-the-art components, controls, and cybersecurity. The feasibility study will be followed by a formal application of Sandia's Energy Surety Design Methodology. EC (6100)

DOE, Sandia, and Texas Tech University commissioned the Scaled Wind Farm Technology (SWiFT) facility at the Reese Technology Center in Lubbock, Texas, on July 9, 2013. The DOE/Sandia managed SWiFT facility is the first of its kind to use multiple wind turbines to measure how wind turbines interact with one another in a wind farm. The facility allows for rapid, cost-efficient testing and development of transformative wind energy technology, with specific emphasis on improving wind plant performance. Advanced testing and monitoring at the site will help researchers evaluate how larger wind farms can become more productive. EC (6100)

Scaled Wind Farm Technology (SWiFT) Facility at the Reese Technology Center in Lubbock, Texas. (Photo by Lloyd Wilson)

TODD LANE

Sandia, led by **Todd Lane (8623)**, was part of a winning proposal team lead by California Polytechnic State University to a recent DOE-EERE funding opportunity on increasing algal biofuel production. The team will conduct research and development work to increase the productivity of algae strains and compare two separate processing technologies. The project will be based at a municipal wastewater treatment plant in Delhi, Calif., that has six acres of algae ponds. Sandia will work on maximizing algal pond growth and monitoring algal pond stability.

A new theoretical analysis has been developed that provides a physical understanding of high-pressure liquid fuel injection in engines. Depending on pressure, this results in the generation of dispersed drops (like a shower nozzle) or turbulent mixing of a continuous jet (with no drops). Insight into the mixing process and how it is controlled by fuel composition and engine conditions has important implications for understanding engine performance. High-speed imaging of the fuel injection process has verified the theoretical predictions. EC (8300)

Innovative biofuels hold the promise of reducing petroleum dependence and enabling new combustion strategies. **Recent work has provided the groundwork for co-optimization of biofuels and new approaches to combustion.** John Gladden (8634) and coworkers have identified fuels formed directly from lignocellulosic biomass by certain fungi. Craig Taatjes (8353) has identified promising fungal products, among them ketones, and characterized their reaction chemistry. And research led by John Dec (8300) has shown that cyclopentanone could substantially improve octane rating, reducing engine knock in engines operating in new high-pressure regimes. EC, LDRD (8300, 8600)

Coherent anti-Stokes Raman spectroscopy, **CARS, has been used in fields of study as diverse as combustion, cell biology, plasma physics, and explosives detection**. Until recently, however, only single-point detection was possible, and sample scanning was required to construct an image of CARS spectra. Researchers have recently invented the first multidimensional CARS spectrometer capable of creating 2-D images of CARS spectra within a single laser shot, opening new research avenues in studies of transient spatial phenomena, such as diffusion, turbulence, and combustion. EC (8300)

Sandia researcher Todd Lane withdraws a sample for analysis from a culture of microalgae used to produce biodiesel. (Photo by Dino Vournas)

HR, finance & legal

Hiring war veterans and supporting the National Guard and Reserve are important to Sandia and part of its diversity and inclusion initiatives to attract, retain, and develop the future workforce. Sandia's diversity strategy is woven into the Labs' culture and institutionalized in its Strategic Objectives. Sandia's hiring of 14 war veterans is an example of why the Labs received the Pro Patria Award from DoD's Employer Support of the Guard & Reserve office and was a nominee for a national Freedom Award. IMS

SANDIA HONORED – New Mexico Gov. Susana Martinez salutes the flag at an Oct. 25 Employer Support of the Guard and Reserve (ESGR) event in Albuquerque. The ESGR New Mexico Patriotic Employer Award Luncheon honored companies — including Sandia — that hired unemployed or underemployed members of the National Guard and Reserve in 2013. (Photo by Randy Montoya)

Sandia's Resource Management Tool drove an integrated systems solution to align PMU budget outlooks with division workforce plans. The result: surpassing various staffing goals and outperforming national benchmarks. Sandia's offer/acceptance rate of 90 percent is among the country's best. The Labs' diverse hiring also is well above noted benchmarks. In 2013, Sandia's hiring strategy resulted in a significant increase of PhD and R&D professionals compared with 2012. Sandia's voluntary separation rate of early career professionals is 2.83 percent, which is among the lowest in the country. IMS

Sandia applied a number of new technologies reaching today's plugged-in audiences, including mobile HBE and recruiting apps, and an International Training app for protection of nuclear facilities and materials. In addition, employees get personalized benefit assistance through a mobile app and the web-based "Ask Alex" program designed to increase an employee's understanding of benefit offerings. Enterprise-leading efforts in social media have broadened coverage of Sandia through a 42 percent increase in Twitter followers, 26 percent jump in Facebook Likes, 17 percent increase in Flickr views, and 2.2 million YouTube views. IMS

HBE kept health care costs low while launching Health Action Plans to reduce health risk and improve productivity. As the nation experienced an 8.7 percent increase in medical premiums, Sandia employees saw only a 1.6 percent increase in 2013. In addition, workers' compensation costs remained low (0.1 percent of payroll) as the Labs excelled in medical case management and innovative transitional return-to-work programs. Meanwhile, a flurry of promotions engaged nearly all employees, many of whom also completed action plans or health risk assessments to improve their health. IMS

The Flex-Life Team created a one-stop-shopping website that links employees to 60+ Flex-Life programs, implemented a detailed communication plan to educate/inform managers and employees about this new resource, created roles/responsibilities for managers and employees regarding administering these programs, and trained managers and employees on flex/life resources. This program was piloted in California, then adopted Labs-wide. NW, DS&A, EC, IHNS (8500)

Sandia's Design Improvement Team — made up of staff, management, and technical professions — helped refine aspects of TotalComp. The team recommended enhancements to the comp tool, performance zone descriptors, and provided feedback on a new manager's portal that houses training materials, action guides, and helpful videos. Meanwhile, 19 job family focus teams combed through all job descriptions and finished with a portfolio that better reflected Sandia's scope of work and aligned work performed with market data. IMS

Sandia launched numerous tools and resources to enhance employees' knowledge and share key capabilities across the Labs. Among the tools were a web resource portal (learn.sandia.gov), a mentor/match tool, and six Engineered Safety videos to assist the workforce during implementation. Best practices from the "Just Culture" philosophy influenced resources to help leaders determine context, culpability, and ensure fair and consistent treatment to enable a learning environment. Additionally, a new training course — WP&C: Criteria for Safe Design-Engineered Safety — was launched to train approximately 250 work planners. IMS

Last year, the Office of Management and Budget and DOE instituted new requirements for conference attendance and approval that profoundly impacted the complex. These requirements have since been altered, reinterpreted, and augmented. Over this period, Travel & Treasury: Conference Management has worked unremittingly to address concerns with the new requirements, improving the approval system, and working across the complex to develop best practices and implement new decision models, all with the intent to better enable Sandia's mission-critical work by streamlining processes and creating efficiencies. DSA, EC, IHNS, NW, IMS (10500)

ES&H Business Operations Dept.10594 developed several Environmental Liability process improvement initiatives in FY13 in support of Sandia's Strategic Objective 3: Lead the complex as a model 21st century national laboratory. A high-quality Sandia Environmental Liability SharePoint site was developed to provide business intelligence, collaboration, presentations, knowledge transfer, and record management. Environmental Liability cost estimates were upgraded to the corporate cost-estimating tool and process mapping documents were developed. The DOE Office of Field Financial Management recognizes Sandia as a model site in conducting this process. DSA, EC, IHNS, NW, IMS (10500)

Sandia developed a time-charging policy that went into effect in FY14. This policy was implemented to ensure Sandia's approach for time-charging is consistent and appropriate across the Laboratories, as well as to ensure the fair treatment of all customers by proportionately allocating all time expended. The policy addressed three main areas: (1) general time-charging requirements; (2) the use of time compression for exempt employees; and (3) the use of management judgment when charging time for professional development and proposal writing. IMS (10600)

Sandia's Legal and Prime Contract organization teamed with Sandia's CIO organization to conduct a review of Personally Identifiable Information (PII). The review included an assessment of electronic and paper PII holdings and information technology systems that collect and store PII. This review showed satisfactory management practices and good employee awareness of information protection principles. Sandia provided recommendations to DOE describing steps taken by Sandia to reduce PII holdings to the minimum necessary; effect appropriate risk-based security controls; implement cost-effective, PII protection improvements; implement tools for automated detection and prevention of loss of electronic PII; and improve employee training and awareness. IMS (11100)

In 2013 Elsevier, the world's leading scientific publisher refused to publish articles submitted by DOE laboratories unless the Government gave up rights in the articles. DOE's refusal resulted in a stalemate with Elsevier. For months, Elsevier refused to publish any articles associated with DOE. **Sandia Senior Managing IP Counsel Kerry Kampschmidt, called Elsevier's general counsel and broke the stalemate**, returning the relationship to normal with DOE retaining its rights. IMS (11000)

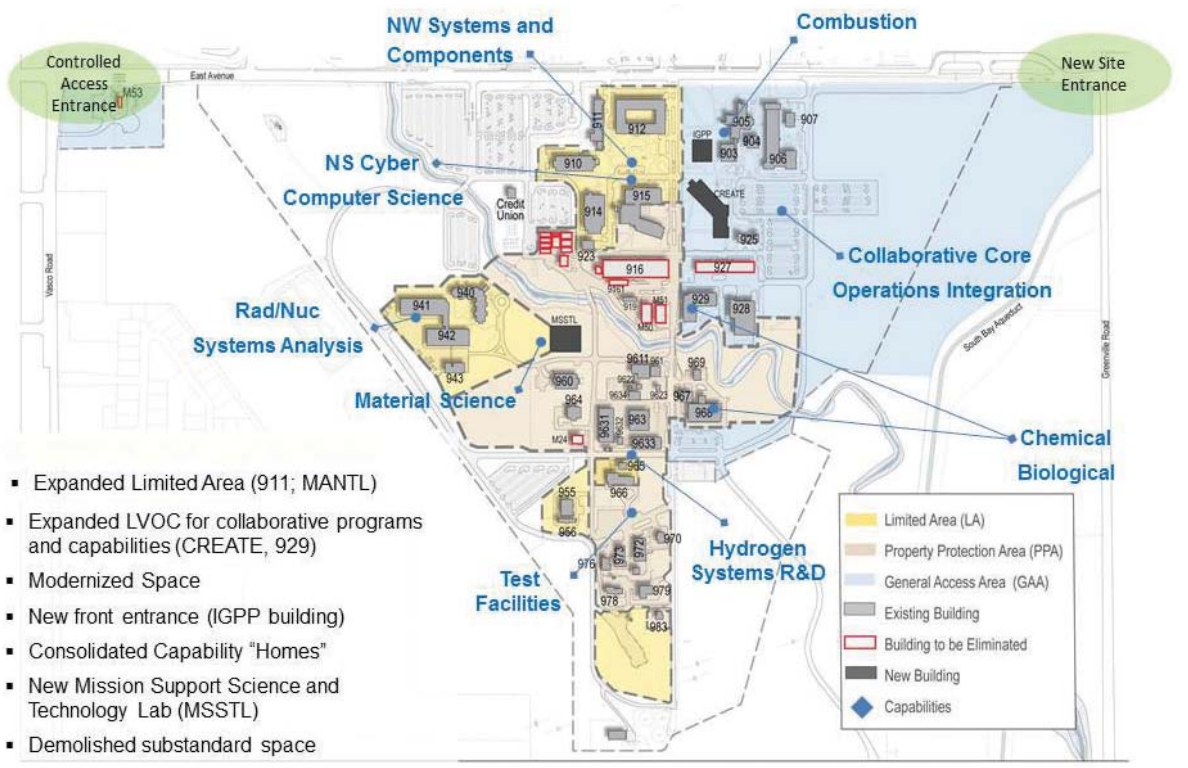
Legal Div. 11000 and employees in several divisions have provided ongoing technical witness expertise, documents, and support in cases of national significance. The cases were brought by the US Department of Justice to support government efforts against British Petroleum for the 2010 Deepwater Horizon oil spill and against landowners for condemnation proceedings in support of the Strategic Petroleum Reserve. IMS (11000)

CINDY LOVATO-FARMER

Senior Counsel **Cindy Lovato-Farmer** effectively managed a complex False Claims Act (FCA) lawsuit to early resolution in 2013. The suit pertained to Sandia's request years earlier for approval to replace the B61 Spin Rocket Motor (SRM). Cindy managed the litigation using experienced counsel and an aggressive and proactive defense, consisting of an early detailed investigation of the underlying technical and funding issues, dedicated engagement and assistance by Sandia B61 SRM subject-matter experts, and ongoing communication with NNSA Sandia Field Office Counsel. The investigation confirmed that the allegations were based on scientific disagreement and divergent engineering judgment, insufficient to establish FCA liability. The approach led to the plaintiffs voluntarily dismissing claims after roughly a year of litigation. Voluntary dismissal is an highly unusual outcome for any lawsuit, particularly for FCA. Cindy has practiced law for 20 years and is a New Mexico Board Certified Specialist in labor and employment law. She was recently promoted to Senior Managing General Law and Litigation Counsel and now manages Sandia's general law attorneys and litigation.

Governance, leadership, & management

Future state of Sandia/California site



The Sandia/California Site Development Plan accelerated in FY13 to allow Div. 8000 to perform national security mission activities. The Sandia/California VP and directors accepted the plan and spearheaded major changes, which include the addition of four buildings to the General Access Area, evacuation of the second floor of Bldg. 910 for future high security needs, and conversion of the second floor of Bldg. 911 plus the south wing of Bldg. 940 to Limited Areas. These actions required significant investment to shift boundaries, move more than 150 office personnel, and relocate 10 laboratories. NW, DS&A, EC, IHNS (8500)

CHIEF TECHNOLOGY OFFICER Julia Phillips introduces Sandia's new Research Challenges initiative. (Photo by Randy Montoya)

Sandia began earnest implementation of its new research strategy. Integral to the larger Laboratory strategy, the research strategy focuses on furthering mission-enabling, differentiating S&T capabilities, tackling transformational, interdisciplinary research challenges, and nurturing Sandia's research environment. In FY13, research challenges took main stage. Teams across the Labs identified a small set that will position Sandia for future mission impact. Four of these were formally unveiled in FY13: Beyond Moore Computing, Data Sciences, First to High-Yield Fusion, and Trusted Systems and Communications. LDRD, All PMUs (1000, 2000, 5000, 6000, 7000, 8000, 9000)

The Information Operations and Proliferation Assessments Programs worked closely with a customer community to invest in Sandia infrastructure in a sustainable, more strategic way. The approach encourages optimization of the Labs' capabilities to eliminate duplication often found in stovepiped approaches in research and development. A community of trust among the different customers has evolved through planning and decision-making to evolve and sustain state-of-the-art national lab capabilities while saving taxpayer dollars. A major accomplishment realized in FY13 was the start of a co-location effort into a single facility in Tech Area 1. This first accomplishment involved numerous mission support functions and was enabled by DOE/NNSA. DSA (5600, others)

The Assurance Maturity Assessment focused on the "Check" portion of the Plan-Do-Check-Act governance model. CFO Div. 10000 received a rating of 4 on a 1-to-5 scale because of a robust and rigorous management review process. The Quality Standard Declaration was a self-assessment of the organization's maturity against the 12 quality criteria in DOE Order 414.1D. The rating of 4 on a 1-to-5 maturity scale was validated by the Management and Assurance Systems Group due to ample evidence to support the rating. All PMUs (10000)

A minimal set of project framework requirements was identified to support corporate Strategic Objective 3 for implementing a common framework that will provide a graded approach to project management activities and increase efficiencies and confidence in Sandia's ability to manage projects. The Project Framework Model has quality, business, and technical components for initiating, planning, executing, monitoring and controlling, and closing activities. Additionally, a defined set of requirements for low, medium, and high level-of-rigor projects to support individual projects' tailoring needs have been identified. All PMUs (10600)

The Nuclear Weapons Program Management Unit published the "FY13 Implementation Plan for the Nuclear Weapons Program at Sandia National Laboratories," which is Sandia's plan for meeting NNSA nuclear weapons program objectives. The plan provides the linkage between key deliverables (used in our assurance system) and higher level program outcomes (used as evidence that we are delivering on expectations specified in the strategic Performance Evaluation Plan between Sandia and NNSA). The plan was piloted in FY13 with plans to refine and continue the approach in FY14. NW

The internal audit groups from Sandia and Los Alamos national laboratories cohosted the 2013 Contractors Internal Audit Directors (CIAD) professional development seminar in July. More than 60 audit directors and managers representing 25 DOE sites attended. The purpose of this DOE-sponsored meeting is to share best practices and knowledge, and network with peers. Sandia was able to provide attendees with 18 hours of continuing professional education for only $85 per person, about one-fifth the cost of previous conferences for an equivalent learning experience. IMS (0800)

THE OPERATIONAL INNOVATION website offers tools and resources to facilitate the Labs' corporate quality implementation.

Mission Support and the Corporate Governance Center contributed to corporate quality implementation in several ways. The effectiveness of Sandia's Plan-Do-Check-Act quality cycle was deepened through improved assessments, measures and metrics, and corrective actions; a corporate baseline for quality-related maturity was established. The center deployed the Operational Innovation management tool, providing a consistent means to capture, evaluate, and validate innovations for implementation, and report the results. Lean Six Sigma work and Parent Company Contributions are now better linked to more fully integrate process efficiency efforts into the total quality improvement cycle. IMS (700)

ES&H & security

Sandia has been storing spent nuclear fuels that were studied in reactor safety experiments more than 30 years ago. The Nuclear Material Management Department has completed analyses of these fuels and developed detailed plans for safely handling the highly radioactive materials. Agreements for final disposition of these legacy materials have been negotiated with two DOE facilities. Repackaging the materials for shipment reduces cost and risk for Sandia and is scheduled for completion by 2015. IMS (1300, 10200, 4100)

The NAC-LWT Type B spent fuel shipping cask.

Sandia matures work planning and control through a deliberate safe-by-design intent, Engineered Safety. At the core of this methodology are principles of technical rigor, systems engineering, and critical thinking. The campaign has led to the development of a corporate manual, *Criteria for Safe Design*, a dynamic decision document repository, training, and teams to support all elements of Engineered Safety implementation. With its consequence-based approach, it has begun to influence thinking and effect design and implementation of engineered controls into new and existing systems and processes. IMS (4100)

REINA BUENCONSEJO (Pomona College) and Colin McGlinchey (Albuquerque High School) complete work at Sandia's Advanced Materials Laboratory, where its unique learning environment is strengthened by including student input, including the development of safety approaches and systems as part of Engineered Safety. (Photo by Randy Montoya)

The Slip Simulator training honors Sandia's commitment to safety. Slip, trip, and fall injuries account for 30 percent of recordable injuries at Sandia. The Slip Simulator is a tool to educate the members of the workforce on safe walking methods to prevent falls. The technology uses kinetic learning — learn by doing — and models Center 4100's Vision Statement, "Work Safely, Go Home Safely." As of October 2013, more than 1,470 members of the workforce have been trained as observers and about 690 (including several executives) have participated. IMS (4100)

The Data Loss Prevention Tool (DLP) prevents unintentional release of sensitive information outside the firewall and creates awareness about the need to encrypt sensitive data. The Security Incident Management Program worked with the Cyber Security, Legal, and Export Control Programs to enhance the tool to quarantine Export Control Information (ECI) and Unclassified Controlled Nuclear Information (UCNI). Since the deployment of the DLP early in FY13, there has been a more than 50 percent reduction for both ECI and UCNI-related events. IMS (4200)

Community involvement

Sandians once again embraced our culture of giving. Sandia set a new record by contributing $5.6 million in 2012 through United Way of Central New Mexico to nonprofits in New Mexico, California, and across the nation. Sandia Serves volunteers logged more than 115,000 hours and completed a 13th Habitat for Humanity house for a deserving family. STEM-focused programs and strategy engaged more than 20,000 students in exciting science, technology, engineering, and math activities, inspiring them to consider technical careers. IMS (All Centers and Divisions)

KELLY WESTLAKE

Kelly Westlake chaired the 2013 corporate Employee Caring Program that helped Sandia eclipse the $6 million threshold helping those most vulnerable in our community. Although much credit goes to the ECP team and the more than 6,500 members of the workforce who contributed, Kelly headed the efforts to grow Sandia's support of the United Way by 9 percent over the prior year. FY13 was extremely trying as there was much unrest due to governmental and economic issues, and the campaign was almost canceled. Through his passion, commitment, persistence, and leadership Sandia delivered. (Photo by Randy Montoya)

Sandia Deputy Labs Director and Executive VP for Mission Support Kim Sawyer shares time with kids at the Boys & Girls Clubs of Central New Mexico, a United Way Agency. Kim is the Board Chair-Elect of United Way of Central New Mexico. (Photo by Lloyd Wilson)

Armida Carbajal (415) stays focused while tracking cyberthreats to Sandia Labs in the Cyber Engineering Research Laboratory. (Photo by Randy Montoya)